Configuration and Use Manual
P/N 20001715, Rev. A
January 2004

Micro Motion® Series 1000 and Series 2000 Transmitters

Configuration and Use Manual

- Model 1500 with analog outputs option board
- Model 1700 with analog outputs option board
- Model 1700 with intrinsically safe outputs option board
- Model 2500 with configurable input/outputs option board
- Model 2700 with analog outputs option board
- Model 2700 with intrinsically safe outputs option board
- Model 2700 with configurable input/outputs option board

Micro Motion™

EMERSON™
Process Management

Micro Motion®
Series 1000 and
Series 2000 Transmitters

Configuration and Use Manual

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Contents

Chapter 1 Before You Begin 1

1.1 Overview 1
1.2 Safety 1
1.3 Determining your transmitter type and version 1
1.3.1 Transmitter type, installation type, and outputs option board 2
1.3.2 Version 3
1.4 Flowmeter documentation 3
1.5 Using this manual 3
1.5.1 Terminology 3
1.5.2 Communication tools 4
1.6 Planning the configuration 5
1.7 Pre-configuration worksheet 5

Chapter 2 Using the Transmitter Display 7

2.1 Overview 7
2.2 Components 7
2.3 Using the optical switches 8
2.4 Using the display 8
2.4.1 Display menus 8
2.4.2 Display password 9
2.4.3 Entering milliamp and frequency range values with the display 9

Chapter 3 Connecting with ProLink II Software 11

3.1 Overview 11
3.2 Requirements 11
3.3 ProLink II configuration upload/download 11
3.4 Connecting from a PC to a Model 1700 or Model 2700 transmitter 12
3.4.1 Connecting to the service port 12
3.4.2 Connecting to the RS-485 terminals or an RS-485 network 14
3.4.3 Connecting to the primary mA terminals or to a HART multidrop network 16
3.5 Connecting from a PC to a Model 1500 or Model 2500 transmitter 19
3.5.1 Connecting to the RS-485 terminals or an RS-485 network 19
3.5.2 HART/Bell202 connections 21

Chapter 4 Connecting with the 275 HART Communicator or 375 Field Communicator 23

4.1 Overview 23
4.2 Communicator models 23
4.2.1 Viewing the device descriptions 24
4.2.2 Using the 275 HART Communicator with the Model 2500 24

4.3 Connecting to a transmitter . . . 25
4.3.1 Connecting to communication terminals . . . 25
4.3.2 Connecting to a multidrop network . . . 27
4.4 Conventions used in this manual . . . 27
4.5 HART Communicator safety messages and notes . . . 27

Chapter 5 Flowmeter Startup . . . 29
5.1 Overview . . . 29
5.2 Applying power . . . 30
5.2.1 Communication methods after power-up . . . 30
5.3 Performing a loop test . . . 31
5.3.1 Loop testing with the display . . . 31
5.3.2 Loop testing with ProLink II . . . 33
5.3.3 Loop testing with a Communicator . . . 34
5.4 Trimming the milliamp outputs . . . 35
5.4.1 Milliamp output trim with ProLink II . . . 35
5.4.2 Milliamp output trim with a Communicator . . . 37
5.5 Zeroing the flowmeter . . . 38
5.5.1 Preparing for zero . . . 38
5.5.2 Zeroing with the display . . . 39
5.5.3 Zeroing with ProLink II . . . 40
5.5.4 Zeroing with a Communicator . . . 41
5.5.5 Zeroing with the Zero button . . . 42

Chapter 6 Required Transmitter Configuration . . . 43
6.1 Overview . . . 43
6.2 Characterizing the flowmeter . . . 44
6.2.1 When to characterize . . . 44
6.2.2 Characterization parameters . . . 44
6.2.3 How to characterize . . . 46
6.3 Configuring transmitter terminals . . . 47
6.3.1 Configuring the channels . . . 47
6.3.2 Configuring terminals 3 & 4 . . . 49
6.4 Configuring the measurement units . . . 49
6.4.1 Mass flow units . . . 50
6.4.2 Volume flow units . . . 51
6.4.3 Density units . . . 52
6.4.4 Temperature units . . . 52
6.5 Configuring the mA output(s) . . . 53
6.5.1 Configuring the process variable . . . 54
6.5.2 Configuring the mA output range (LRV and URV) . . . 55
6.5.3 Configuring the AO cutoff(s) . . . 55
6.5.4 Configuring the fault indicator and fault value . . . 56
6.5.5 Configuring added damping . . . 57
6.6 Configuring the frequency output(s) . . . 58
6.6.1 Configuring the process variable . . . 59
6.6.2 Configuring the output scale . . . 60
6.6.3 Configuring the maximum pulse width . . . 61
6.6.4 Configuring the frequency output polarity . . . 62
6.6.5 Configuring mode . . . 63
6.6.6 Configuring the fault indicator . . . 64

6.7 Configuring the discrete output(s) 64
6.7.1 Flow switch 67
6.8 Configuring the discrete input 67

Chapter 7 Using the Transmitter 69
7.1 Overview 69
7.2 Special applications 69
7.3 Recording process variables 69
7.4 Viewing process variables 70
7.4.1 With the display 70
7.4.2 With ProLink II 70
7.4.3 With a Communicator 70
7.5 Viewing API process variables 71
7.5.1 With the display 71
7.5.2 With ProLink II 71
7.5.3 With a Communicator 71
7.6 Viewing transmitter status and alarms 71
7.6.1 Using the status LED 72
7.6.2 Using the display 72
7.6.3 Using ProLink II 73
7.6.4 Using the Communicator 73
7.7 Acknowledging alarms 74
7.8 Using the totalizers and inventories 74
7.8.1 Viewing the totalizers and inventories 74
7.8.2 Viewing the API totalizers and inventories 76
7.8.3 Controlling totalizers and inventories 76

Chapter 8 Optional Configuration 79
8.1 Overview 79
8.2 Configuration map 79
8.3 How to access a parameter for configuration 79
8.4 Creating special measurement units 81
8.4.1 About special measurement units 81
8.4.2 Special mass flow unit 82
8.4.3 Special volume flow unit 82
8.4.4 Special unit for gas 82
8.5 Configuring the petroleum measurement application (API feature) 83
8.5.1 About the petroleum measurement application 83
8.6 Configuring cutoffs 86
8.6.1 Cutoffs and volume flow 86
8.6.2 Interaction with the AO cutoffs 86
8.7 Configuring the damping values 86
8.7.1 Damping and volume measurement 87
8.7.2 Interaction with the added damping parameter 87
8.7.3 Interaction with the update rate 87
8.8 Configuring the update rate 87
8.9 Configuring the flow direction parameter 88
8.10 Configuring events 92
8.10.1 Reporting event status 92
8.11 Configuring slug flow limits and duration 92
8.12 Configuring fault timeout 93
8.13 Configuring meter factors 93
8.13.1 Calculating meter factors 93

8.14 Configuring the display 94
8.14.1 Enabling and disabling display parameters 94
8.14.2 Changing the scroll rate 95
8.14.3 Changing the off-line password 95
8.14.4 Changing the display variables 95
8.15 Configuring digital communications 96
8.15.1 Changing the fault indicator 96
8.15.2 Changing the HART polling address 97
8.15.3 Changing the Modbus address 97
8.15.4 Changing the RS-485 parameters 97
8.15.5 Configuring HART burst mode 99
8.15.6 Configuring the PV, SV, TV, and QV assignments 100
8.16 Configuring device settings 101
8.17 Configuring sensor parameters 102

Chapter 9 Pressure Compensation, Temperature Compensation, and Polling 103
9.1 Overview 103
9.2 Pressure compensation 103
9.2.1 Options 103
9.2.2 Pressure correction factors 104
9.2.3 Pressure measurement unit 104
9.2.4 Configuration 105
9.3 External temperature compensation 106
9.4 Configuring polling 107

Chapter 10 Troubleshooting 111
10.1 Overview 111
10.2 Guide to troubleshooting topics 111
10.3 Micro Motion customer service 112
10.4 Transmitter does not operate 112
10.5 Transmitter does not communicate 112
10.6 Zero or calibration failure 113
10.7 Fault conditions 113
10.8 HART output problems 113
10.9 Milliamp and frequency output problems 113
10.10 Transmitter status LED 116
10.10.1 Model 1500/2500 transmitters 116
10.10.2 Model 1700/2700 transmitters with displays 116
10.11 Status alarms 117
10.12 Checking process variables 122
10.13 Diagnosing wiring problems 125
10.13.1 Checking the power supply wiring 125
10.13.2 Checking the sensor-to-transmitter wiring 125
10.13.3 Checking grounding 126
10.13.4 Checking for RF interference 126
10.13.5 Checking the HART communication loop 126
10.14 Checking the communication device 126
10.15 Checking the output wiring and receiving device 127
10.16 Checking slug flow 128
10.17 Checking output saturation 128
10.18 Setting the HART polling address to zero 129
10.19 Checking the flow measurement unit 129

10.20 Checking the upper and lower range values . . . 129
10.21 Checking the frequency output scale and method . . . 129
10.22 Checking the characterization . . . 129
10.23 Checking the calibration . . . 129
10.24 Checking the test points . . . 130
10.24.1 Obtaining the test points . . . 130
10.24.2 Evaluating the test points . . . 130
10.24.3 Excessive drive gain . . . 131
10.24.4 Erratic drive gain . . . 131
10.24.5 Low pickoff voltage . . . 132
10.25 Checking the core processor . . . 132
10.25.1 Checking the core processor LED . . . 132
10.25.2 Core processor resistance test . . . 134
10.26 Checking sensor coils and RTD . . . 136
10.26.1 9-wire remote or remote core processor with remote transmitter installation . . . 136
10.26.2 4-wire remote or integral installation . . . 137

Appendix A Default Values and Ranges . . . 141
A.1 Overview . . . 141
A.2 Most frequently used defaults and ranges . . . 141

Appendix B Flowmeter Installation Types and Components . . . 145
B.1 Overview . . . 145
B.2 Model 1500/2500 transmitters . . . 145
B.2.1 Installation diagrams . . . 145
B.2.2 Component diagrams . . . 145
B.2.3 Wiring and terminal diagrams . . . 145
B.3 Model 1700/2700 transmitters . . . 149
B.3.1 Installation diagrams . . . 149
B.3.2 Component diagrams . . . 149
B.3.3 Wiring and terminal diagrams . . . 150

Appendix C Calibrating the Transmitter . . . 157
C.1 Overview . . . 157
C.2 About calibration . . . 157
C.3 Density calibration . . . 157
C.3.1 Preparing for density calibration . . . 158
C.3.2 Density calibration procedures . . . 158
C.4 Temperature calibration . . . 164

Appendix D Configuring the Enhanced Density Application . . . 165
D.1 About this chapter . . . 165
D.2 Configuration overview . . . 165
D.3 Application options – Standard or custom curves . . . 165
D.4 About enhanced density . . . 166
D.4.1 The density curve . . . 166
D.4.2 Data points . . . 169

D.5 Configuration procedure 169
D.5.1 Loading a standard or custom curve 169
D.5.2 Specifying the active curve 170
D.6 Density curve trim 171
D.7 Modifying a density curve 172
D.8 Saving a density curve 172

Appendix E Menu Flowcharts – Model 1500 AN Transmitters 173
E.1 Overview 173
E.2 Model 1500 output board 173
E.3 Communication tool requirements 173
E.3.1 ProLink II 173
E.3.2 Communicator 173
E.4 Version information 174

Appendix F Menu Flowcharts – Model 2500 CIO Transmitters 183
F.1 Overview 183
F.2 Communication tool requirements 183
F.2.1 ProLink II 183
F.2.2 Communicator 183
F.3 Version information 183

Appendix G Menu Flowcharts – Model 1700/2700 AN Transmitters 193
G.1 Overview 193
G.2 Version information 193

Appendix H Menu Flowcharts – Model 1700/2700 IS Transmitters 209
H.1 Overview 209
H.2 Version information 209

Appendix I Menu Flowcharts – Model 2700 CIO Transmitters 225
I.1 Overview 225
I.2 Version information 225

Appendix J Display Codes and Abbreviations 241
J.1 Overview 241
J.2 Codes and abbreviations 241

Index 245

Chapter 1
Before You Begin

1.1 Overview

This chapter provides an orientation to the use of this manual, and includes a pre-configuration worksheet. This manual describes the procedures required to start, configure, use, maintain, and troubleshoot the following Series 1000 and Series 2000 transmitters:

- Model 1500 with analog outputs option board
- Model 1700 with analog outputs option board
- Model 1700 with intrinsically safe outputs option board
- Model 2500 with configurable input/outputs option board
- Model 2700 with analog outputs option board
- Model 2700 with intrinsically safe outputs option board
- Model 2700 with configurable input/outputs option board

If you do not know what transmitter you have, see Section 1.3 for instructions on identifying the transmitter type from the model number on the transmitter's tag.

Note: Information on configuration and use of Model 2700 transmitters with the FOUNDATION™ fieldbus or Profibus-PA option board is provided in separate manuals. See the manual for your transmitter.

1.2 Safety

Safety messages are provided throughout this manual to protect personnel and equipment. Read each safety message carefully before proceeding to the next step.

1.3 Determining your transmitter type and version

To configure, use, and troubleshoot the transmitter, you must know your transmitter type, installation type, outputs option board, and several different types of version information. This section provides instructions for this information. Record this information in the pre-configuration worksheet in Section 1.7.

1.3.1 Transmitter type, installation type, and outputs option board

To determine your transmitter type, installation type, and outputs option board:

1. Obtain the transmitter's model number, which is provided on a tag attached to the side of the transmitter.
   - Model 1500 transmitters have a model number of the form **1500xxxxxxxxxx**.
   - Model 2500 transmitters have a model number of the form **2500xxxxxxxxxx**.
   - Model 1700 transmitters have a model number of the form **1700xxxxxxxxxx**.
   - Model 2700 transmitters have a model number of the form **2700xxxxxxxxxx**.
2. The fifth character in the model number (**xxxxXxxxxxxxxx**) represents the installation type that was ordered:
   - **R** = remote (4-wire remote installation)
   - **I** = integral (transmitter mounted on sensor)
   - **C** = transmitter/core processor assembly (9-wire remote installation)
   - **B** = remote core processor with remote transmitter
   - **D** = DIN rail (for Model 1500 or 2500 transmitters in 4-wire remote installations)

Note: For more information on installation type, see Appendix B.

3. The eighth character in the model number (**xxxxxxxXxxxxxx**) represents the outputs option board:
   - **A** = transmitter with analog outputs option board (one mA, one frequency, one RS-485)
   - **B** = transmitter with configurable input/outputs option board, default output configuration (two mA, one frequency)
   - **C** = transmitter with configurable input/outputs option board, customized output configuration
   - **D** = transmitter with intrinsically safe outputs option board

Note: The remaining characters in the model number describe options that do not affect transmitter configuration or use.

The following examples illustrate use of the model number to determine transmitter type, installation type, and output board type:

- **1700RxxAxxxxxx** = Model 1700 remote transmitter with analog outputs option board
- **2700CxxDxxxxxx** = Model 2700 transmitter/core processor assembly with intrinsically safe outputs option board

1.3.2 Version

Different configuration options are available with different versions of the components. Table 1-1 lists the version information that you may need and describes how to obtain the information.

Table 1-1 Obtaining version information

Component	With ProLink II	With Communicator	With Display
Transmitter software	View/Installed Options/ Software Revision	Review/Device info/ Software rev	OFF-LINE MAINT/VER
Core processor software	Not available	Review/Device info/ Hardware rev	OFF-LINE MAINT/VER
ProLink II	Help/About ProLink II	Not applicable	Not applicable
Communicator device description	Not applicable	See Section 4.2.2	Not applicable

1.4 Flowmeter documentation

Table 1-2 lists documentation sources for additional information.

Table 1-2 Flowmeter documentation resources

Topic	Document
Sensor installation	Sensor documentation
Transmitter installation: Model 1500/2500 transmitters	*Transmitter Installation: Model 1500 and 2500 Transmitters*
Transmitter installation: Model 1700/2700 transmitters	*Transmitter Installation: Model 1700 and 2700 Transmitters*

1.5 Using this manual

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

This manual describes features and procedures that apply to most or all of the Series 1000 and 2000 transmitters. To help you identify the topics that apply to your transmitter, a list of transmitters is supplied with topic headings (see the example to the left of this paragraph). If no list is supplied with the topic heading, the topic is applicable to all transmitters.

1.5.1 Terminology

Table 1-3 lists definitions for the terms and codes that are used in this manual.

Table 1-3 Terms and codes used in this manual

Term	Definition
Series 1000	Refers to the following transmitters: • Model 1500 • Model 1700
Series 2000	Refers to the following transmitters: • Model 2500 • Model 2700
Model 1500	Refers to the following transmitter: • Model 1500 with the analog outputs option board

Table 1-3 Terms and codes used in this manual (continued)

Term	Definition
Model 1700	Refers to the following transmitters: • Model 1700 with the analog outputs option board • Model 1700 with the intrinsically safe outputs option board
Model 2500	Refers to the following transmitter: • Model 2500 with the configurable input/outputs option board
Model 2700	Refers to the following transmitters: • Model 2700 with the analog outputs option board • Model 2700 with the intrinsically safe outputs option board • Model 2700 with the configurable input/outputs option board
AN	Analog outputs option board. Available with the following transmitters: • Model 1500 with the analog outputs option board • Model 1700 with the analog outputs option board • Model 2700 with the analog outputs option board
IS	Intrinsically safe outputs option board. Available with the following transmitters: • Model 1700 with the intrinsically safe outputs option board • Model 2700 with the intrinsically safe outputs option board
CIO	Configurable input/outputs option board. Available with the following transmitters: • Model 2500 with the configurable input/outputs option board • Model 2700 with the configurable input/outputs option board

1.5.2 Communication tools

Most of the procedures described in this manual require the use of a communication tool. Table 1-4 lists the transmitters discussed in this manual, and the communication tools that can be used with them.

Table 1-4 Transmitters and communication tools

Transmitter	Transmitter display(1)	ProLink II software	Communicator
Model 1500		✓(2)	✓(3)
Model 1700 with analog outputs option board	✓	✓	✓
Model 1700 with intrinsically safe outputs option board	✓	✓	✓
Model 2500 with configurable input/outputs option board		✓	✓(4)
Model 2700 with analog outputs option board	✓	✓	✓
Model 2700 with intrinsically safe outputs option board	✓	✓	✓
Model 2700 with configurable input/outputs option board	✓	✓	✓

(1) Model 1700 and 2700 transmitters may be ordered with or without a display.
(2) Requires ProLink II v2.1 or later.
(3) Requires 375 Field Communicator.
(4) Partial support available with 275 HART Communicator; requires 375 Field Communicator for full support.

In this manual:

- Basic information on using the display is provided in Chapter 2.
- Basic information on ProLink II and connecting ProLink II to your transmitter is provided in Chapter 3. For more information, see the ProLink II manual, available on the Micro Motion website (www.micromotion.com).
- Basic information on the 275 HART Communicator, the 375 Field Communicator, and connecting the Communicator to your transmitter, is provided in Chapter 4. For more information, see the HART Communicator or Field Communicator documentation available on the Micro Motion website (www.micromotion.com).

You may be able to use other tools from Emerson Process Management, such as AMS. Use of AMS is not dicussed in this manual; however, the user interface that AMS provides is similar to the ProLink II user interface.

1.6 Planning the configuration

The pre-configuration worksheet in Section 1.7 provides a place to record information about your flowmeter (transmitter and sensor) and your application. This information will affect your configuration options as you work through this manual. Fill out the pre-configuration worksheet and refer to it during configuration. You may need to consult with transmitter installation or application process personnel to obtain the required information.

If you are configuring multiple transmitters, make copies of this worksheet and fill one out for each individual transmitter.

1.7 Pre-configuration worksheet

Note: Not all options are available for all transmitters.

Item	Configuration data
Sensor type	☐ T-Series ☐ Other
Transmitter model number	_____
Transmitter model	☐ 1500 ☐ 1700 ☐ 2500 ☐ 2700
Installation type	☐ Integral ☐ 4-wire remote ☐ 9-wire remote ☐ Remote core processor with remote transmitter
Output option board	☐ Analog (AN) ☐ Intrinsically safe (IS) ☐ Configurable input/outputs (CIO)
Transmitter software version	_____
Core processor software version	_____

Item		Configuration data	
Outputs	Terminals 1 & 2 **or** Terminals 21 & 22 **or** Channel A	☐ Milliamp (no options) ☐ Used for HART/Bell202 digital communications	
	Terminals 3 & 4 **or** Terminals 23 & 24 **or** Channel B	☐ Milliamp ☐ Frequency ☐ Discrete output	☐ Internal power ☐ External power
	Terminals 5 & 6 **or** Terminals 31 & 32 **or** Channel C	☐ Milliamp ☐ Frequency ☐ RS-485 ☐ Discrete output ☐ Discrete input	☐ Internal power ☐ External power
Process variable or assignment	Terminals 1 & 2 **or** Terminals 21 & 22 **or** Channel A	_____	
	Terminals 3 & 4 **or** Terminals 23 & 24 **or** Channel B	_____	
	Terminals 5 & 6 **or** Terminals 31 & 32 **or** Channel C	_____	
Measurement units	Mass flow	_____	
	Volume flow	_____	
	Density	_____	
	Pressure	_____	
	Temperature	_____	
Installed applications		☐ Petroleum measurement (API) ☐ Enhanced density ☐ Custody transfer	
ProLink II version		_____	
Communicator device description version		_____	

Chapter 2
Using the Transmitter Display

2.1 Overview

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The transmitter display provides basic configuration and management functionality. This chapter describes the user interface of the transmitter display. The following topics are discussed:

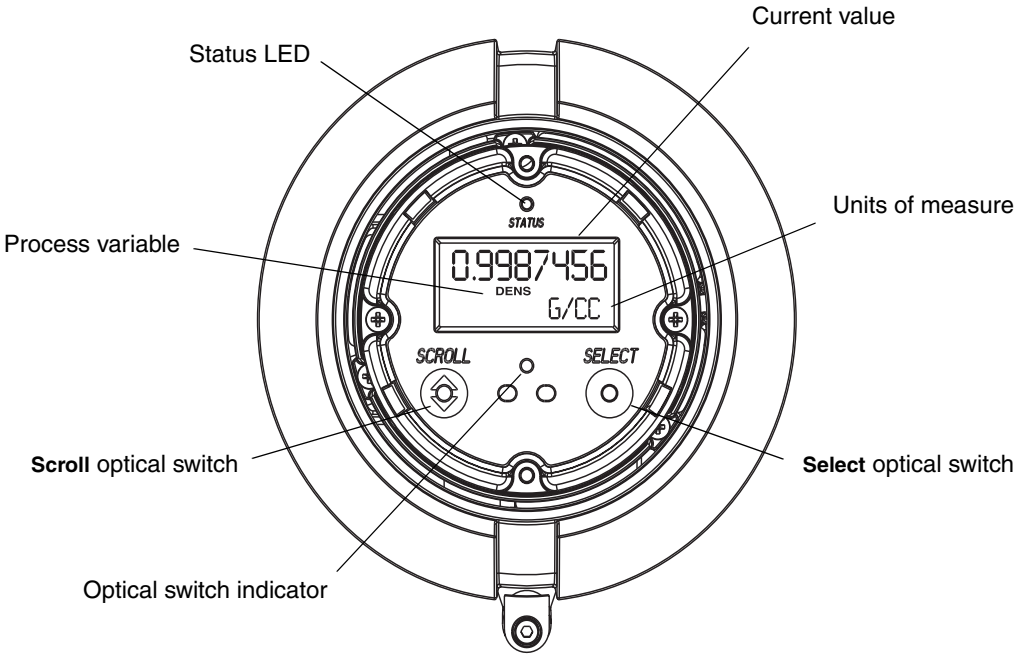
- Display components (see Section 2.2)
- Using the **Scroll** and **Select** optical switches (see Section 2.3)
- Using the display (see Section 2.4.2)

Note that the Model 1500 and 2500 transmitters do not have displays, and the Model 1700 and 2700 transmitters can be ordered with or without displays. Not all configuration and use functions are available through the display. If you need the added functionality, or if your transmitter does not have a display, you must use either ProLink II or the Communicator to communicate with the transmitter.

2.2 Components

Figure 2-1 illustrates the display components.

Figure 2-1 Display components



2.3 Using the optical switches

The **Scroll** and **Select** optical switches are used to navigate the transmitter display. To activate an optical switch, touch the glass in front of the optical switch or move your finger over the optical switch close to the glass. The optical switch indicator will be solid red when a single switch is activated, and will flash red when both switches are activated simultaneously.

⚠ WARNING

Removing the display cover in an explosive atmosphere can cause an explosion.

When using the optical switches, do not remove the display cover. To activate an optical switch, touch the glass of the display cover or move your finger over the switch close to the glass.

2.4 Using the display

In ordinary use, the **Process variable** line on the display shows the configured display variables, and the **Units of measure** line shows the measurement unit for that process variable.

- See Section 8.14.4 for information on configuring the display variables.
- See Appendix J for information on the codes and abbreviations used for display variables.

If more than one line is required to describe the display variable, the **Units of measure** line alternates between the measurement unit and the additional description. For example, if the display is showing a mass inventory value, the **Units of measure** line alternates between the measurement unit (**G**) and the name of the inventory (**MASSI**).

Auto scroll may or may not be enabled:

- If Auto scroll is enabled, each configured display variable will be shown for the number of seconds specified for Scroll rate.
- Whether Auto scroll is enabled or not, the operator can manually scroll through the configured display variables by activating **Scroll**.

For more information on using the display to view process variables or manage totalizers and inventories, see Chapter 7.

2.4.1 Display menus

To enter the display menus, activate **Scroll** and **Select** simultaneously. The optical switch indicator will flash. Hold **Scroll** and **Select** until the words **SEE ALARM** or **OFF-LINE MAINT** appear.

To move through a list of options, activate **Scroll**.

To select from a list, scroll to the desired option, then activate **Select**.

To exit a display menu without making any changes:

- Use the **EXIT** option if available.
- If the **EXIT** option is not available, activate **Scroll** and **Select** simultaneously, and hold until the screen returns to the previous display.

2.4.2 Display password

Some of the display functions, such as the off-line menu and resetting totalizers, can be protected by a password. For information about enabling and setting the password, refer to Section 8.14.

Note: If the petroleum measurement application is enabled on your transmitter, an off-line password is always required to start, stop, or reset a totalizer, even if the display off-line password parameter is disabled.

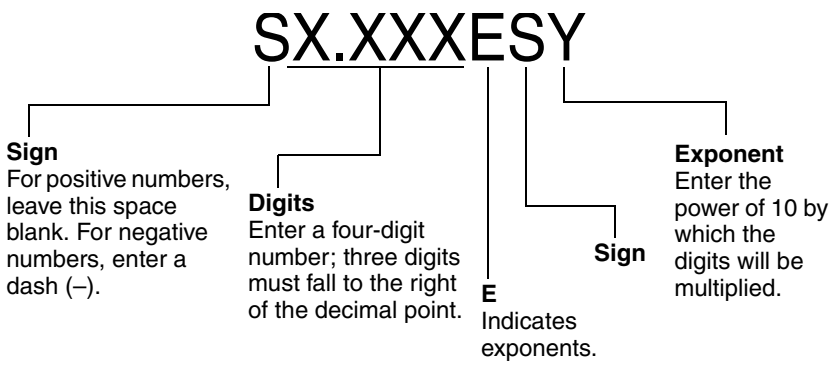
If a password is required, the word **CODE?** appears at the top of the password screen. Enter the digits of the password one at a time by using **Scroll** to choose a number and **Select** to move to the next digit.

If you encounter the display password screen but do not know the password, wait 60 seconds without activating any of the display optical switches. The password screen will time out automatically and you will be returned to the previous screen.

2.4.3 Entering milliamp and frequency range values with the display

If you are using the display to change transmitter settings, the display uses a standard format and procedure for entering range values for either mA or frequency outputs.

Enter range and scale values in scientific notation according to the following format:


SX.XXXESY
Sign
For positive numbers, leave this space blank. For negative numbers, enter a dash (–).
Digits
Enter a four-digit number; three digits must fall to the right of the decimal point.
E
Indicates exponents.
Sign
Exponent
Enter the power of 10 by which the digits will be multiplied.

Example of range value format

The correct format for the number –810,000 is shown below:

```
–8.100E 5
```

To enter mA or frequency range values with the display:

Note: This procedure assumes that you are already at the correct point in the display menu to begin entering the range values.

1. **Scroll**, if necessary, until the first space is either a minus sign (–) for a negative number or a blank space for a positive number.
2. **Select**.
3. **Scroll** until the first digit is the correct number.
4. **Select**.
5. **Scroll** until the second digit is the correct number.
6. **Select**.
7. **Scroll** until the third digit is the correct number.

8. **Select**.
9. **Scroll** until the fourth digit is the correct number.
10. **Select**.
11. **Scroll**, if necessary, until the sign for the exponent is either a dash (–) for a negative exponent or a blank space for a positive exponent.
12. **Select**.
13. **Scroll** until the exponent is the correct power of 10.
14. **Scroll** and **Select** simultaneously for four seconds to save and exit.

Chapter 3
Connecting with ProLink II Software

3.1 Overview

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

ProLink II is a Windows-based configuration and management tool for Micro Motion transmitters. It provides complete access to transmitter functions and data.

This chapter provides basic information for connecting ProLink II to your transmitter. The following topics and procedures are discussed:

- Requirements (see Section 3.2)
- Configuration upload/download (see Section 3.3)
- Connecting to a Model 1700 or 2700 transmitter (see Section 3.4)
- Connecting to a Model 1500 or 2500 transmitter (see Section 3.5)

The instructions in this manual assume that users are already familiar with ProLink II software. For more information on using ProLink II, or for detailed instructions on installing ProLink II, see the ProLink II software manual, which is available on the Micro Motion web site (www.micromotion.com).

3.2 Requirements

To use ProLink II with a Series 1000 or 2000 transmitter, the following are required:

- ProLink II v2.0 or later
- Signal converter, to convert the PC's serial port signal to the signal used by the transmitter
  - For RS-485 connections, an RS-485 to RS-232 signal converter. The Black Box® Async RS-232 <-> 2-wire RS-485 Interface Converter (Code IC521A-F) signal converter is available from Micro Motion. Contact Micro Motion if you need an RS-485 signal converter.
  - For Bell 202 connections, a HART interface. The MACTek® Viator® RS232 HART® Interface is available from Micro Motion. Contact Micro Motion if you need a HART interface.
- 25-pin to 9-pin adapter (if required by your PC)

3.3 ProLink II configuration upload/download

ProLink II provides a configuration upload/download function which allows you to save configuration sets to your PC. This allows:

- Easy backup and restore of transmitter configuration
- Easy replication of configuration sets

Micro Motion recommends that all transmitter configurations be downloaded to a PC as soon as the configuration is complete.

To access the configuration upload/download function:

1. Connect ProLink II to your transmitter as described in this chapter.
2. Open the **File** menu.
   - To save a configuration file to a PC, use the **Load from Xmtr to File** option.
   - To restore or load a configuration file to a transmitter, use the **Send to Xmtr from File** option.

3.4 Connecting from a PC to a Model 1700 or Model 2700 transmitter

Depending on your transmitter, there are several options for connecting ProLink II to your transmitter. See Table 3-1.

Note: Service port connections use standard settings, do not require transmitter configuration, and are always available. Therefore, they are easy and convenient. However, service port connections require opening the power supply compartment. Accordingly, service port connections should be used only for temporary connections, and may require extra safety precautions.

Note: Due to the design of HART protocol, connections made using HART protocol are slower than connections that use Modbus protocol. If you use HART protocol, you cannot open more than one ProLink II window at a time.

Table 3-1 Connection options for Model 1700 or Model 2700 transmitters

			Transmitter		
Connection	**Physical layer**	**Protocol**	**1700/2700 AN**	**1700/2700 IS**	**2700 CIO**
Service port (see Section 3.4.1)	RS-485	Modbus	✓	✓	✓
RS-485 terminals or RS-485 network (see Section 3.4.2)	RS-485	Modbus	✓		
	RS-485	HART	✓		
Primary mA terminals or HART network (see Section 3.4.3)	Bell 202	HART	✓	✓	✓

3.4.1 Connecting to the service port

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

To connect to the service port, which is located in the non-intrinsically safe power supply compartment (see Figure 3-1):

1. Attach the signal converter to the serial port of your PC, using a 25-pin to 9-pin adapter if required.
2. Open the cover to the wiring compartment.

⚠ WARNING

Opening the wiring compartment in a hazardous area can cause an explosion.

Because the wiring compartment must be open to make this connection, the service port should be used only for temporary connections, for example, for configuration or troubleshooting purposes.

When the transmitter is in an explosive atmosphere, use a different method to connect to your transmitter.

3. Open the power supply compartment.

⚠ WARNING

Opening the power supply compartment in explosive atmospheres while the power is on can cause an explosion.

Before using the service port to communicate with the transmitter in a hazardous area, make sure the atmosphere is free of explosive gases.

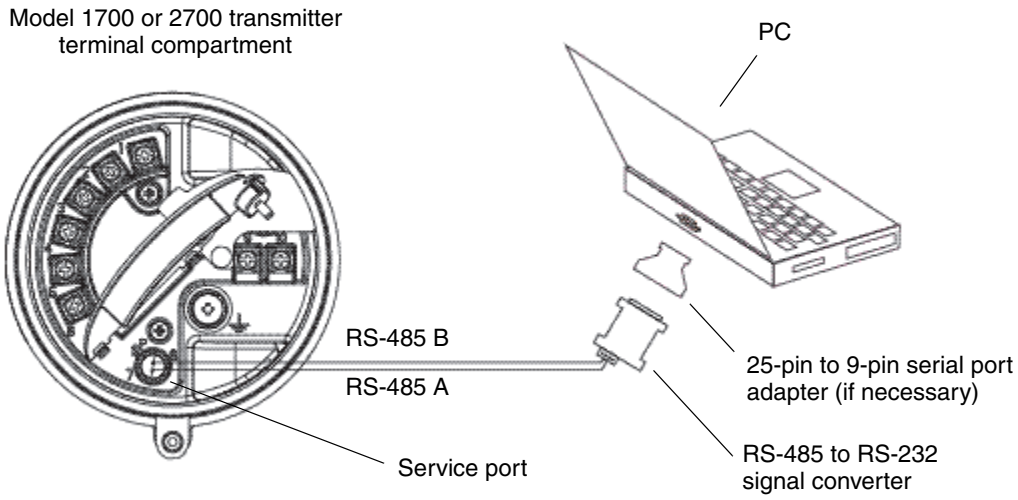
⚠ WARNING

Opening the power supply compartment can expose the operator to electric shock.

To avoid the risk of electric shock, do not touch the power supply wires or terminals while using the service port.

4. Connect the signal converter leads to the service port terminals. See Figure 3-1.

Figure 3-1 Service port connections to Model 1700 or 2700



5. Start ProLink II software. From the Connection menu, click on **Connect to Device**. In the screen that appears, specify:
   - **Protocol**: Universal Service Port

Note: Universal Service Port, or USP, is the ProLink II term for the service port.

   - **COM Port**: as appropriate for your PC

All other parameters are set to service port required values and cannot be changed.

6. Click the **Connect** button. ProLink will attempt to make the connection.
7. If an error message appears:
   a. Swap the leads between the two service port terminals and try again.
   b. Ensure that you are using the correct COM port.
   c. Check all the wiring between the PC and the transmitter.

3.4.2 Connecting to the RS-485 terminals or an RS-485 network

- Model 1700 AN
- Model 2700 AN

To connect a PC to the RS-485 terminals or an RS-485 network:

1. Attach the signal converter to the serial port of your PC, using a 25-pin to 9-pin adapter if required.
2. To connect to the RS-485 terminals, open the cover to the wiring compartment and connect the signal converter leads to the transmitter terminals labeled **5** and **6**, or to the output wires from these terminals. See Figure 3-2.
3. To connect to an RS-485 network, connect the signal converter leads to any point in the network. See Figure 3-3.
4. For long-distance communication, or if noise from an external source interferes with the signal, install 120 Ω, 1/2 watt resistors in parallel with the output at both ends of the communication segment.

Figure 3-2 RS-485 terminal connections to Model 1700 or 2700

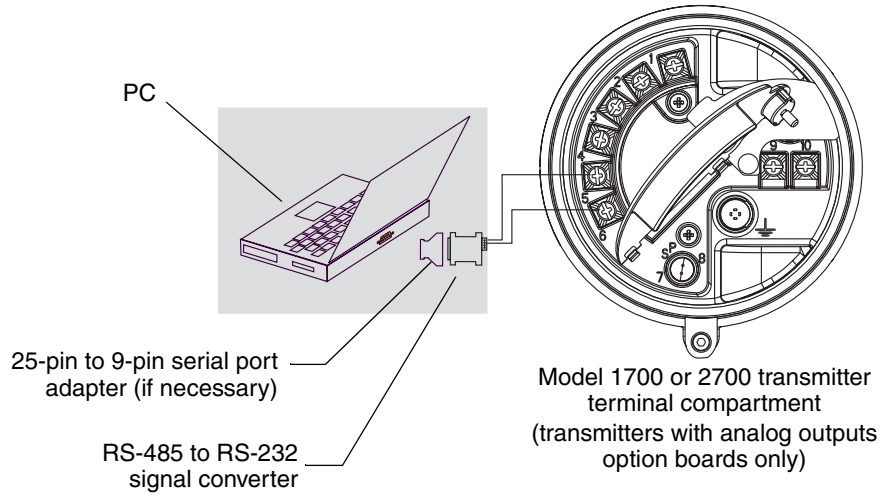
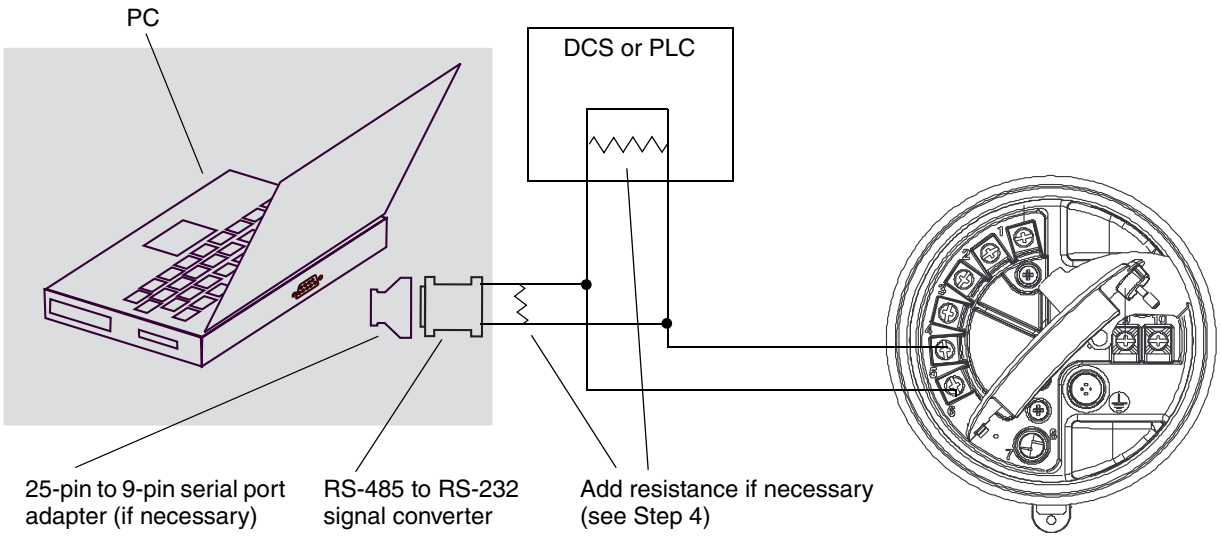

PC
25-pin to 9-pin serial port adapter (if necessary)
RS-485 to RS-232 signal converter
Model 1700 or 2700 transmitter terminal compartment
(transmitters with analog outputs option boards only)

Figure 3-3 RS-485 network connections to Model 1700 or 2700


PC
DCS or PLC
25-pin to 9-pin serial port adapter (if necessary)
RS-485 to RS-232 signal converter
Add resistance if necessary (see Step 4)

5. Start ProLink II software. From the Connection menu, click on **Connect to Device**.
6. Set **Protocol**, **Baud Rate**, **Stop Bits**, and **Parity** to the RS-485 values configured in the transmitter. See Section 8.15.

Note: If you do not know the transmitter's RS-485 configuration, you can connect through the service port, which always uses default settings, or you can use the Communicator or the display to view or change the transmitter's RS-485 configuration. Default RS-485 communication parameters are listed in Table 8-10.

7. Set the **Address/Tag** value to the Modbus or HART polling address configured for the transmitter. The default Modbus address is 1; the default HART polling address is 0. See Section 8.15.
8. Set the **COM Port** value to the PC COM port assigned to this connection.
9. Click the **Connect** button. ProLink will attempt to make the connection.

10. If an error message appears:
    a. Swap the leads and try again.
    b. You may be using incorrect connection parameters.
        - Ensure you are using the correct COM port.
        - Connect using the service port and check the RS-485 configuration. If required, change the configuration or change your RS-485 connection parameters to match the existing configuration.
        - If you are unsure of the transmitter's address. use the **Poll** button in the **Connect** window to return a list of all devices on the network.
    c. Check all the wiring between the PC and the network. You may need to add resistance. See Figure 3-3.

3.4.3 Connecting to the primary mA terminals or to a HART multidrop network

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

⚠ CAUTION

Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error.

If the primary mA output is being used for flow control, connecting a HART interface to the output loop could cause the transmitter's 4–20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a HART interface to the transmitter's primary mA output loop.

To connect a PC to the primary mA terminals or to a HART multidrop network:

1. If you are connecting to an AN or CIO transmitter, see Figure 3-4. If you are connecting to an IS transmitter, see Figure 3-5.
2. Attach the HART interface to the serial port of your PC.
3. To connect to the primary mA terminals, open the cover to the intrinsically safe wiring compartment and connect the HART interface leads to the terminals labeled **1** and **2**, or to the output wires from these terminals.
4. To connect to a HART multidrop network, connect the HART interface leads to any point on the network.

Figure 3-4 HART/Bell202 connections to Model 1700/2700 AN or Model 2700 CIO

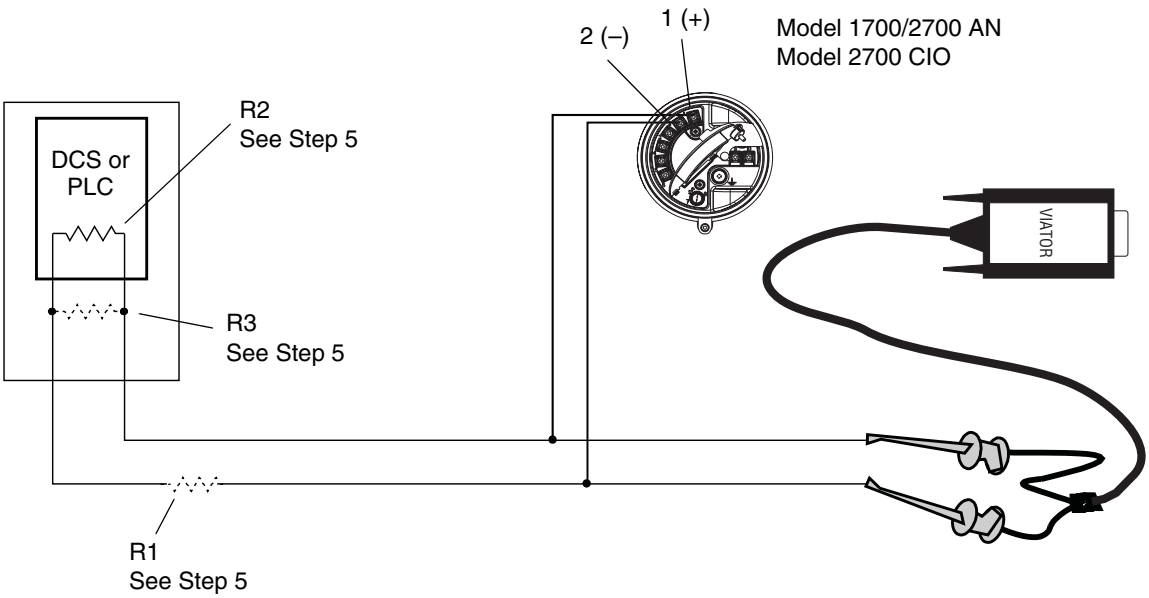
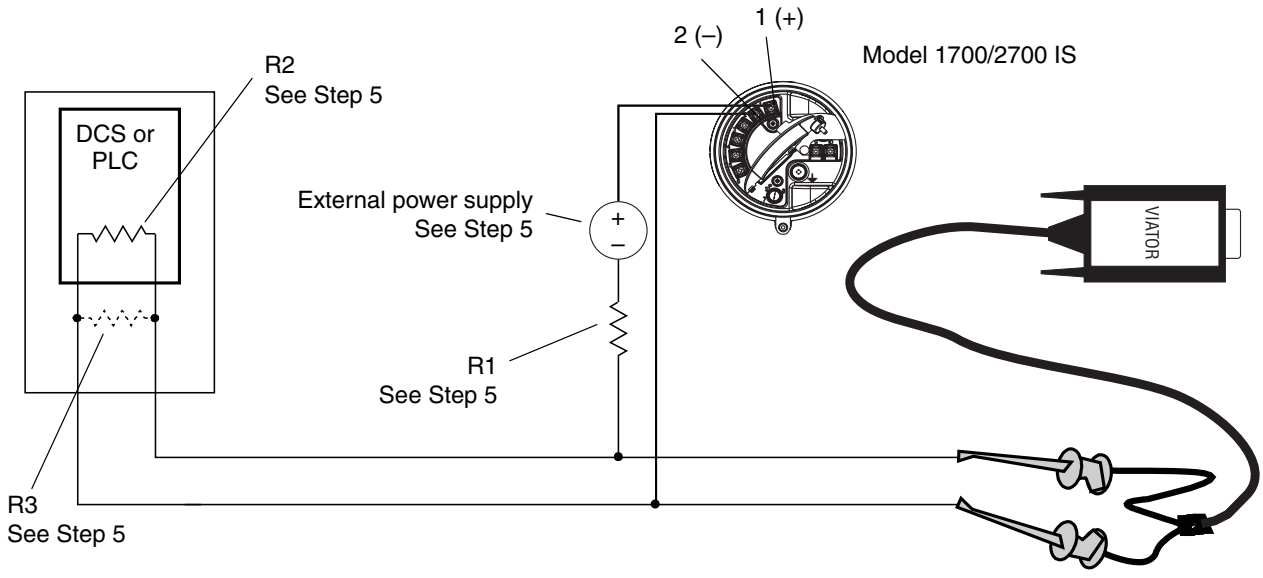
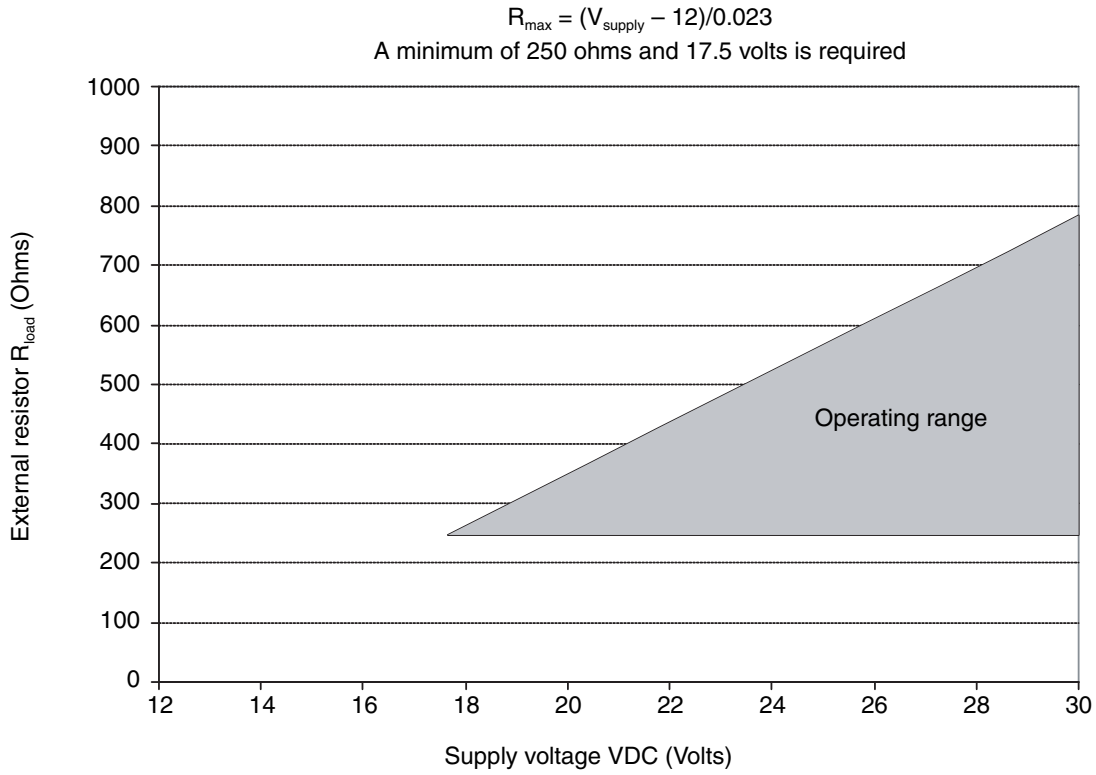


Figure 3-5 HART/Bell202 connections to Model 1700/2700 IS



5. Add resistance as required. The Viator HART interface must be connected across a resistance of 250–600 Ω. In addition, if you are using an IS transmitter, the primary mA output requires an external power supply with a minimum of 250 Ω and 17.5 volts (see Figure 3-6). To meet the resistance requirements, you may use any combination of resistors R1, R2, and R3 (see Figure 3-4 or 3-5).

Figure 3-6 Model 1700/2700 IS: Resistance and voltage requirements for HART/Bell202 connections



6. Start ProLink II software. From the Connection menu, click on **Connect to Device**.
7. Set **Protocol** to HART Bell 202. **Baud rate**, **Stop bits**, and **Parity** are automatically set to the values required by HART protocol.
8. Set the **Address/Tag** value to the HART polling address configured for the transmitter. The default HART polling address is 0. See Section 8.15 for information on the HART polling address.
9. Set the **COM Port** value to the PC COM port assigned to this connection.
10. Set **Master** as appropriate:
    - If another host such as a DCS is on the network, set **Master** to Secondary.
    - If no other host is on the network, set **Master** to Primary.

Note: The 275 HART Communicator or 375 Field Communicator is not a host.

11. Click the **Connect** button. ProLink will attempt to make the connection.
12. If an error message appears:
    a. You may be using incorrect connection parameters.
       - Ensure you are using the correct COM port.
       - If you are unsure of the transmitter's address, use the **Poll** button in the **Connect** window to return a list of all devices on the network.
    b. Check all the wiring between the PC and the transmitter.
    c. Increase or decrease resistance.

3.5 Connecting from a PC to a Model 1500 or Model 2500 transmitter

• Model 1500 AN
• Model 2500 CIO

ProLink II software can communicate with a Model 1500 or Model 2500 transmitter using:

- Modbus/RS485 protocol (see Section 3.5.1)
  - Configurable connection
  - SP (service port) standard connection
- A HART/Bell202 connection (see Section 3.5.2)

Note: Service port connections use standard settings and do not require transmitter configuration. Therefore, they are easy and convenient. However, service port connections are available only for the 10-second interval after power-up. See Step 5 in the following section.

Note: Due to the design of HART protocol, connections made using HART protocol are slower than connections that use Modbus protocol. If you use HART protocol, you cannot open more than one ProLink II window at a time.

3.5.1 Connecting to the RS-485 terminals or an RS-485 network

To connect a PC to the RS-485 terminals or an RS-485 network:

1. Attach the signal converter to the serial port of your PC, using a 25-pin to 9-pin adapter if required.
2. To connect to the RS-485 terminals, connect the signal converter leads to terminals 33 and 34. See Figure 3-7.
3. To connect to an RS-485 network, connect the signal converter leads to any point in the network. See Figure 3-8.
4. For long-distance communication, or if noise from an external source interferes with the signal, install 120 Ohm, 1/2 watt resistors in parallel with the output at both ends of the communication segment.

Figure 3-7 RS-485 terminal connections to Model 1500 or 2500

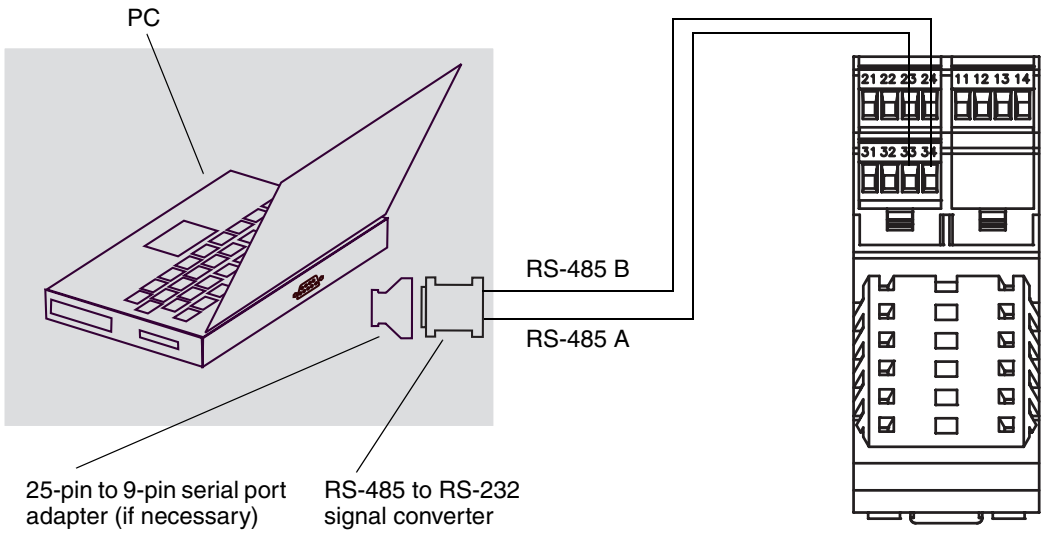
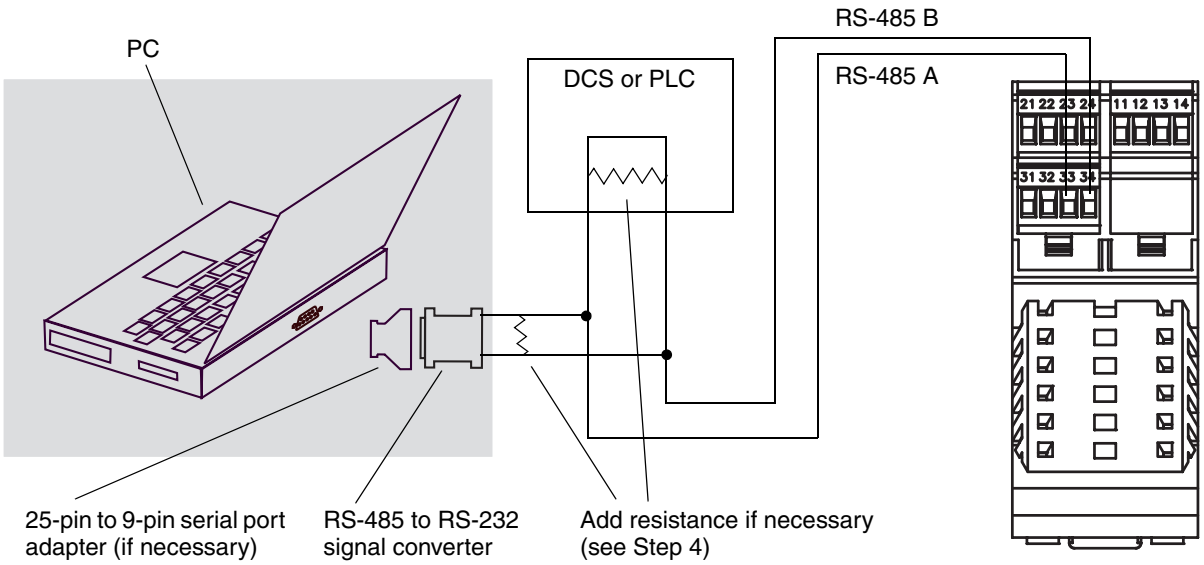


Figure 3-8 RS-485 network connections to Model 1500 or 2500


PC
DCS or PLC
RS-485 B
RS-485 A
21 22 23 24
11 12 13 14
31 32 33 34
25-pin to 9-pin serial port adapter (if necessary)
RS-485 to RS-232 signal converter
Add resistance if necessary (see Step 4)

5. Start ProLink II software. From the Connection menu, click on **Connect to Device**. In the screen that appears, specify connection parameters appropriate to your connection:
   - Immediately after the transmitter is powered up, terminals 33 and 34 are available in service port mode for 10 seconds. To connect during this period, set **Protocol** to Service Port, and set **COM port** to the appropriate value for your PC. **Baud rate**, **Stop bits**, and **Parity** are set to standard values and cannot be changed (see Table 3-2).
   - If no connection is made during the 10-second period, the terminals are automatically reset to the configured RS-485 communication parameters. To connect, set the connection parameters to the values configured in your transmitter (see Table 3-2).

Table 3-2 Modbus connection parameters for ProLink II

	Connection type	
Connection parameter	**Configurable (RS-485 mode)**	**SP standard (service port mode)**
Protocol	As configured in transmitter (default = Modbus RTU)	Modbus RTU(1)
Baud rate	As configured in transmitter (default = 9600)	38,400(1)
Stop bits	As configured in transmitter (default = 1)	1(1)
Parity	As configured in transmitter (default = odd)	none(1)
Address/Tag	Configured Modbus address (default = 1)	111(1)
COM port	COM port assigned to PC serial port	COM port assigned to PC serial port

(1) Required value; cannot be changed by user.

6. Click the **Connect** button. ProLink will attempt to make the connection.

7. If an error message appears:
   a. Swap the leads between the two terminals and try again.
   b. Ensure you are using the correct COM port.
   c. If you are in RS-485 mode, you may be using incorrect connection parameters.
      - Connect using the service port and check the RS-485 configuration. If required, change the configuration or change your RS-485 connection parameters to match the existing configuration.
      - If you are unsure of the transmitter's address. use the **Poll** button in the **Connect** window to return a list of all devices on the network.
   d. Check all the wiring between the PC and the transmitter.

3.5.2 HART/Bell202 connections

⚠ CAUTION

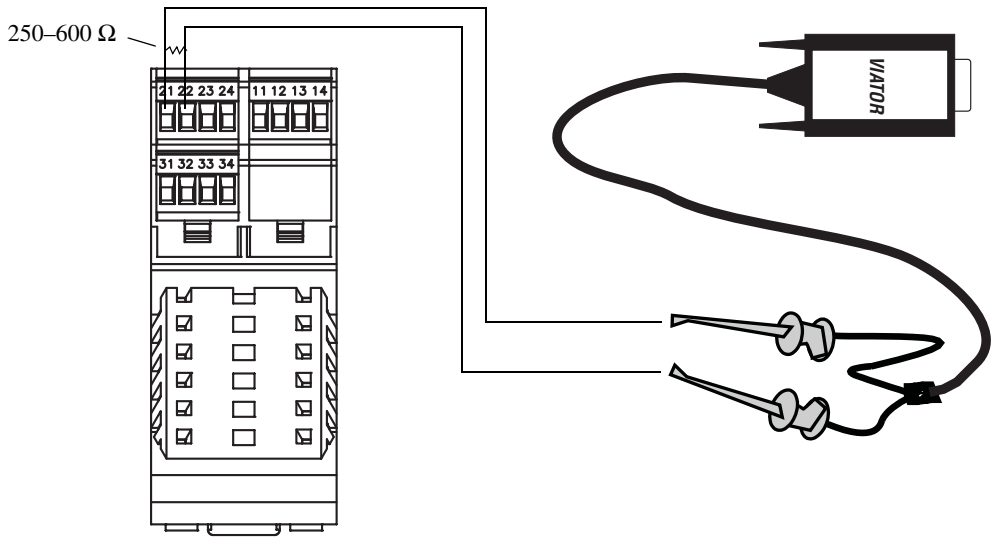
Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error.

If the primary mA output is being used for flow control, connecting a HART interface to the output loop could cause the transmitter's 4–20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a HART interface to the transmitter's primary mA output loop.

HART/Bell202 connections are made through terminals 21 and 22. See Figure 3-9.

Figure 3-9 HART/Bell202 connections to Model 1500 or 2500



Follow the instructions below to make the connection.

1. Connect the HART interface to your PC's serial port. Then connect the leads of the HART interface to terminals 21 and 22.
2. Add 250–600 Ω resistance to the connection, as required.
3. Start ProLink II software. From the Connection menu, click on **Connect to Device**.
4. In the screen that appears, set **Protocol** to HART Bell 202. **Baud rate**, **Stop bits**, and **Parity** are automatically set to the values required by HART protocol. Specify the remaining connection parameters as shown in Table 3-3.

Table 3-3 HART connection parameters for ProLink II

Connection parameter	HART setting
Address/Tag	Configured HART polling address (default = 0)
COM port	COM port assigned to PC serial port

5. Click the **Connect** button. ProLink will attempt to make the connection.
6. If an error message appears:
   a. Ensure that you are using the correct COM port.
   b. Check all the wiring between the PC and the transmitter.
   c. Increase or decrease the resistance.

Chapter 4
Connecting with the 275 HART Communicator or 375 Field Communicator

4.1 Overview

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The 275 HART Communicator and the 375 Field Communicator are handheld configuration and management tools for HART-compatible devices, including Micro Motion transmitters. It provides complete access to transmitter functions and data.

This chapter provides basic information for connecting the 275 HART Communicator or 375 Field Communicator to your transmitter. The following topics and procedures are discussed:

- Communicator Models (see Section 4.2)
- Connecting to a transmitter (see Section 4.3)
- Conventions used in this manual (see Section 4.4)

The instructions in this manual assume that users are already familiar with the Communicator and can perform the following tasks:

- Turn on the Communicator
- Navigate the Communicator menus
- Establish communication with HART-compatible devices
- Transmit and receive configuration information between the Communicator and HART-compatible devices
- Use the alpha keys to type information
- If you are unable to perform the tasks listed above, consult the Communicator manual before attempting to use the software. The documentation is available on the Micro Motion website (www.micromotion.com).

4.2 Communicator models

Two models of the Communicator—the 275 HART Communicator and the 375 Field Communicator—can be used with Series 1000 and Series 2000 transmitters. However, the 275 HART Communicator does not have device descriptions for all models. In some cases, you can communicate with a transmitter using an outdated device description that provides partial support for the new transmitter's features.

Table 4-1 lists the Communicator device descriptions that are available for Series 1000 and 2000 transmitters, and the type of support they provide.

Table 4-1 Communicator models, device descriptions, and transmitter support

	275 HART Communicator		375 Field Communicator	
Transmitter	**Device description**	**Support**	**Device description**	**Support**
Model 1500 AN	Not available		1500 Mass Flow	Full
Model 1700 AN	1000 Mass Flow	Full	1000 Mass Flow	Full
Model 1700 IS	1000I Mass Flow	Full	1000I Mass Flow	Full
Model 2500 CIO	2000C Mass Flow(1)	Partial	2000C Mass Flow	Full
Model 2700 AN	2000 Mass Flow	Full	2000 Mass Flow	Full
Model 2700 IS	2000I Mass Flow	Full	2000I Mass Flow	Full
Model 2700 CIO	2000C Mass Flow	Full	2000C Mass Flow	Full

(1) See Section 4.2.2 for information on using the 275 HART Communicator with this transmitter.

4.2.1 Viewing the device descriptions

HART Communicator 275

To view the device descriptions that are installed on your 275 HART Communicator:

1. Turn on the HART Communicator, but do not connect it to the transmitter.
2. When the words **No device found** appear, press **OK**.
3. Select **OFFLINE**.
4. Select **New Configuration**.
5. Select **Micro Motion**.

375 Field Communicator

To view the device descriptions that are installed on your 375 Field Communicator:

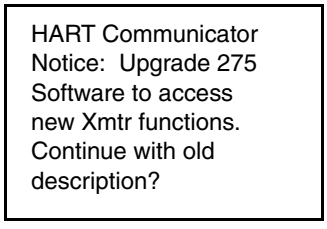
1. At the HART application menu, select **Utility**.
2. Select **Available Device Descriptions**.
3. Select **Micro Motion**.

4.2.2 Using the 275 HART Communicator with the Model 2500

• Model 2500 CIO

To use the 275 HART Communicator with the Model 2500 transmitter:

1. Turn on the HART Communicator and connect it to the transmitter. The following warning message is displayed:



2. Press **Yes** to continue using the 275 HART Communicator. Do not upgrade the 275 HART Communicator.

Note: This procedure allows you to use the device description for the Model 2700 transmitter with the configurable input/outputs option board. You will not be able to configure the RS-485 parameters using this device description. To configure the RS-485 parameteres, use the 375 Field Communicator or ProLink II.

4.3 Connecting to a transmitter

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

You can connect the Communicator directly to the transmitter's mA/HART terminals or to a point on a HART network.

Note: If you are using the mA/HART terminals to report a process variable and also for HART communication, see the transmitter installation manual for wiring diagrams.

4.3.1 Connecting to communication terminals

To connect the Communicator directly to the transmitter's mA/HART terminals:

⚠ CAUTION

Connecting a HART device to the transmitter's primary mA output terminals could cause transmitter output error.

If the primary mA output is being used for flow control, connecting a HART interface to the output loop could cause the transmitter's 4–20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a HART interface to the transmitter's primary mA output loop.

1. If you are connecting to a Model 1700/2700 transmitter, open the cover to the wiring compartment.

⚠ WARNING

Opening the wiring compartment in a hazardous area can cause an explosion.

Because the wiring compartment must be open to make this connection, connections to the mA terminals should be used only for temporary connections, for example, for configuration or troubleshooting purposes.

When the transmitter is in an explosive atmosphere, use a different method to connect to your transmitter.

2. Connect the Communicator leads to the transmitter's primary mA output terminals:
   - Model 1700/2700 transmitters: terminals 1 and 2 (see Figure 4-1)
   - Model 1500/2500 transmitters: terminals 21 and 22 (see Figure 4-2)
3. The Communicator must be connected across a resistance of 250–600 Ω. Add resistance to the connection. See Figure 4-1.

Figure 4-1 Connecting to communication terminals – Model 1700/2700 transmitters

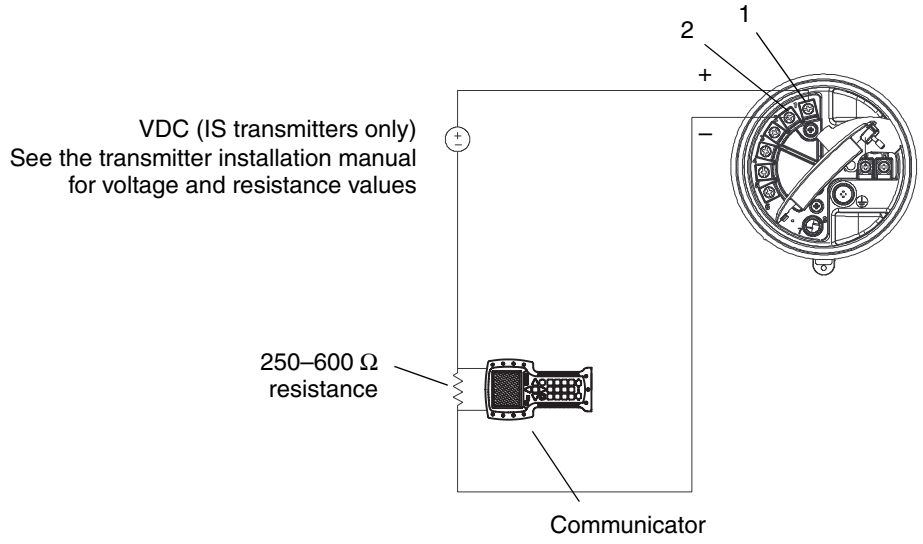
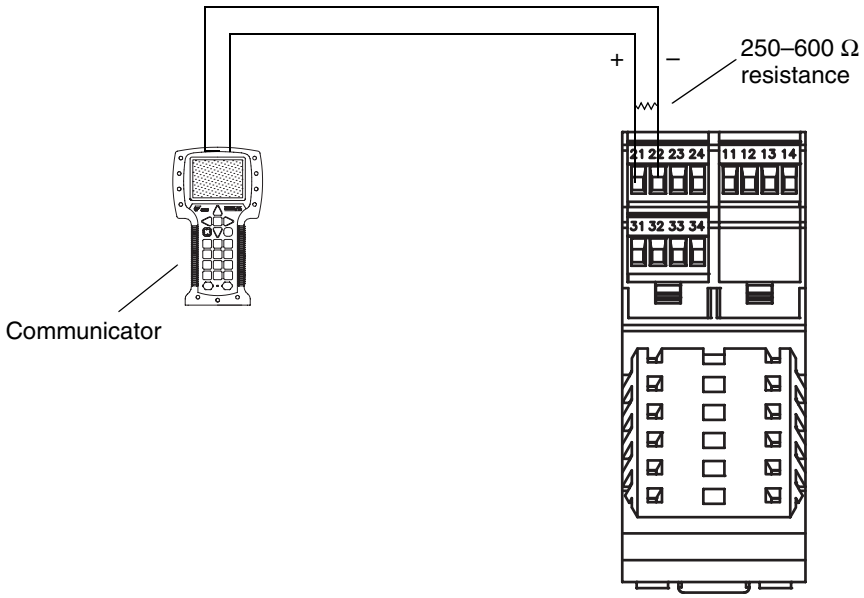


Figure 4-2 Connecting to communication terminals – Model 1500/2500 transmitters

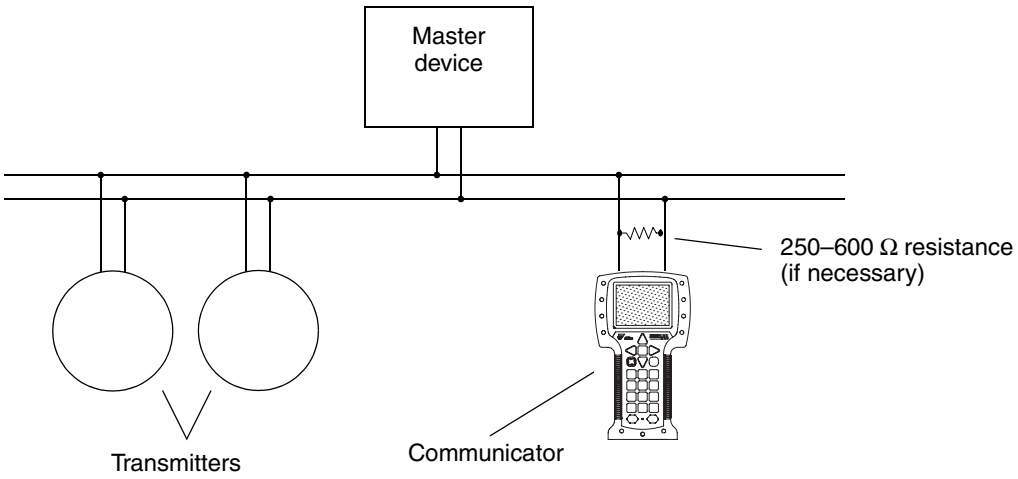


4.3.2 Connecting to a multidrop network

The Communicator can be connected to any point in a multidrop network. See Figure 4-3.

Note: The Communicator must be connected across a resistance of 250–600 Ω. Add resistance to the connection if necessary.

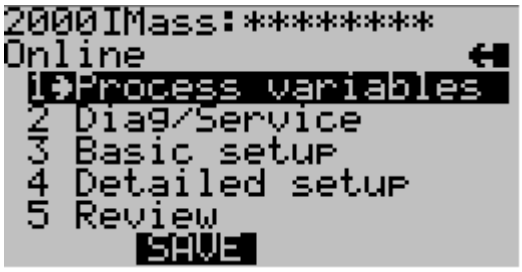
Figure 4-3 Connecting to a multidrop network



4.4 Conventions used in this manual

All Communicator procedures assume that you are starting at the on-line menu. "Online" appears on the top line of the Communicator main menu when the Communicator is at the on-line menu. Figure 4-4 shows the 275 HART Communicator on-line menu for the Model 2700 transmitter with the intrinsically safe outputs option board.

Figure 4-4 275 HART Communicator on-line menu



4.5 HART Communicator safety messages and notes

Users are responsible for responding to safety messages (e.g., warnings) and notes that appear on the Communicator. Safety messages and notes that appear on the Communicator are not discussed in this manual.

Chapter 5
Flowmeter Startup

5.1 Overview

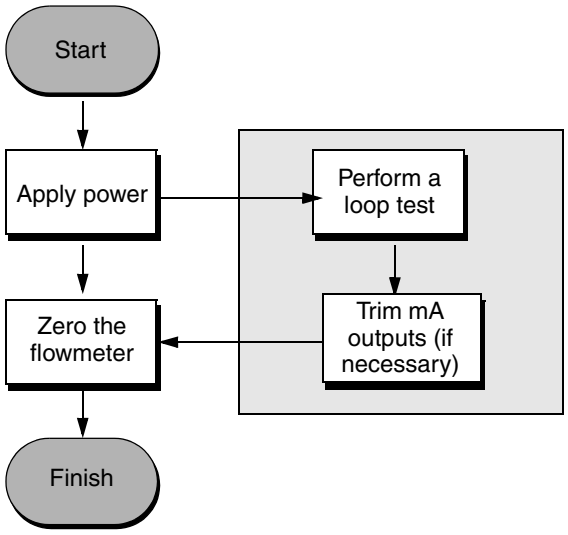
This chapter describes the procedures you should perform the first time you start the flowmeter. You do not need to use these procedures every time you cycle power to the flowmeter.

The following procedures are discussed:

- Applying power to the flowmeter (see Section 5.2)
- Zeroing the flowmeter (see Section 5.5)
- Performing a loop test on the transmitter outputs (see Section 5.3)
- Trimming the mA outputs (see Section 5.4)

Figure 5-1 provides an overview of the flowmeter startup procedures.

Figure 5-1 Startup procedures



Note: All ProLink II procedures provided in this chapter assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Chapter 3 for more information.

Note: If you are using AMS, the AMS interface will be similar to the ProLink II interface described in this chapter.

Note: All Communicator procedures provided in this chapter assume that you are starting from the "Online" menu. See Chapter 4 for more information.

5.2 Applying power

Before you apply power to the flowmeter, close and tighten all housing covers.

⚠ WARNING

Operating the flowmeter without covers in place creates electrical hazards that can cause death, injury, or property damage.

Make sure safety barrier partition and covers for the field-wiring, circuit board compartments, electronics module, and housing are all in place before applying power to the transmitter.

⚠ WARNING

Using the service port to communicate with a Model 1700/2700 transmitter in a hazardous area can cause an explosion.

Before using the service port to communicate with the transmitter in a hazardous area, make sure the atmosphere is free of explosive gases.

Turn on the electrical power at the power supply. The flowmeter will automatically perform diagnostic routines. When the flowmeter has completed its power-up sequence:

- For Model 1700/2700 transmitters under normal conditions, the status LED on the display will turn green and begin to flash,
- For Model 1500/2500 transmitters under normal conditions, the status LED will turn green.
- If the status LED exhibits different behavior, an alarm condition is present or transmitter zero is in progress. See Section 7.6.

5.2.1 Communication methods after power-up

For Model 1700/2700 transmitters, all communication methods supported by the transmitter are available immediately after power-up.

For Model 1500/2500 transmitters:

- If you are using the Communicator, or ProLink II with HART protocol (HART/Bell202), you can establish communication with the transmitter immediately after power-up, using terminals 21 and 22. See Chapter 4 for more information on using the Communicator, or Chapter 3 for more information on using ProLink II.
- If you are using ProLink II via the RS-485 physical layer, terminals 33 and 34 are available in service port mode for 10 seconds immediately after power-up. If no connection is made during this period, the terminals are automatically reset to the configured Modbus communication parameters. Be sure to set the ProLink II connection parameters appropriately. See Chapter 3.

5.3 Performing a loop test

A *loop test* is a means to:

- Verify that analog outputs (mA and frequency) are being sent by the transmitter and received accurately by the receiving devices
- Determine whether or not you need to trim the mA outputs
- Select and verify the discrete output voltage
- Read the discrete input

Perform a loop test on all inputs and outputs available on your transmitter. Before performing the loop tests, ensure that your transmitter terminals are configured for the input/outputs that will be used in your application (see Section 6.3).

You can perform a loop test with the display, with ProLink II, or the Communicator.

5.3.1 Loop testing with the display

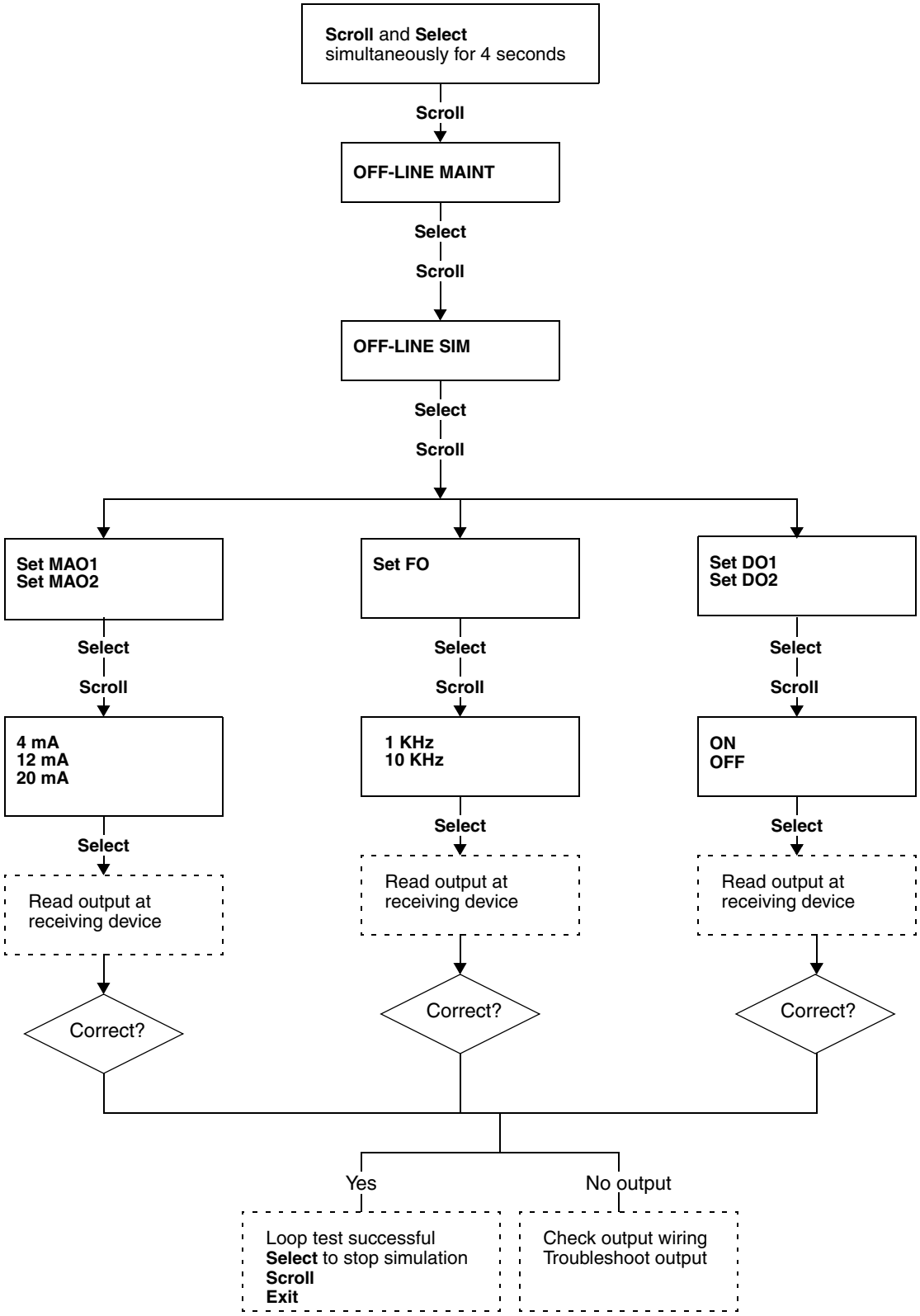
- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-2 for the loop test procedure. Not all options are available on all transmitters.

Note the following:

- The display cannot be used to test the discrete input. If your transmitter has a discrete input, use ProLink II or a Communicator to perform the discrete input loop test.
- The mA reading does not need to be exact. You will correct differences when you trim the mA output. See Section 5.4.
- While the output is fixed:
  - Dots traverse the top line of the display.
  - The status LED blinks yellow.
- When the output is unfixed:
  - The dots disappear.
  - The status LED returns to the state it was in before the output was fixed.

Figure 5-2 Display – Loop test procedure



5.3.2 Loop testing with ProLink II

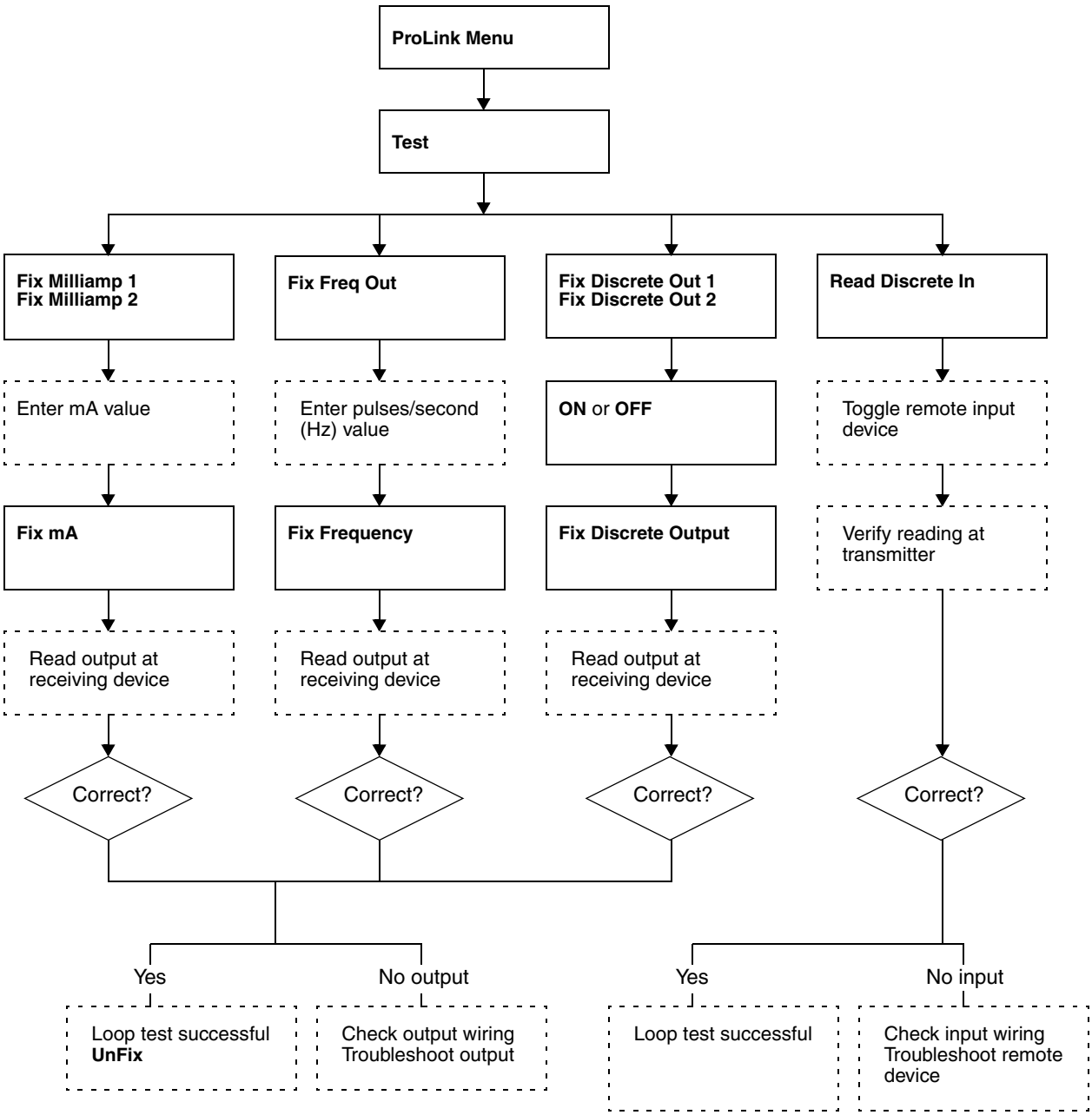
- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-3 for the loop test procedure. Not all options are available on all transmitters.

Note the following:

- The mA reading does not need to be exact. You will correct differences when you trim the mA output. See Section 5.4.

Figure 5-3 ProLink II – Loop test procedure



5.3.3 Loop testing with a Communicator

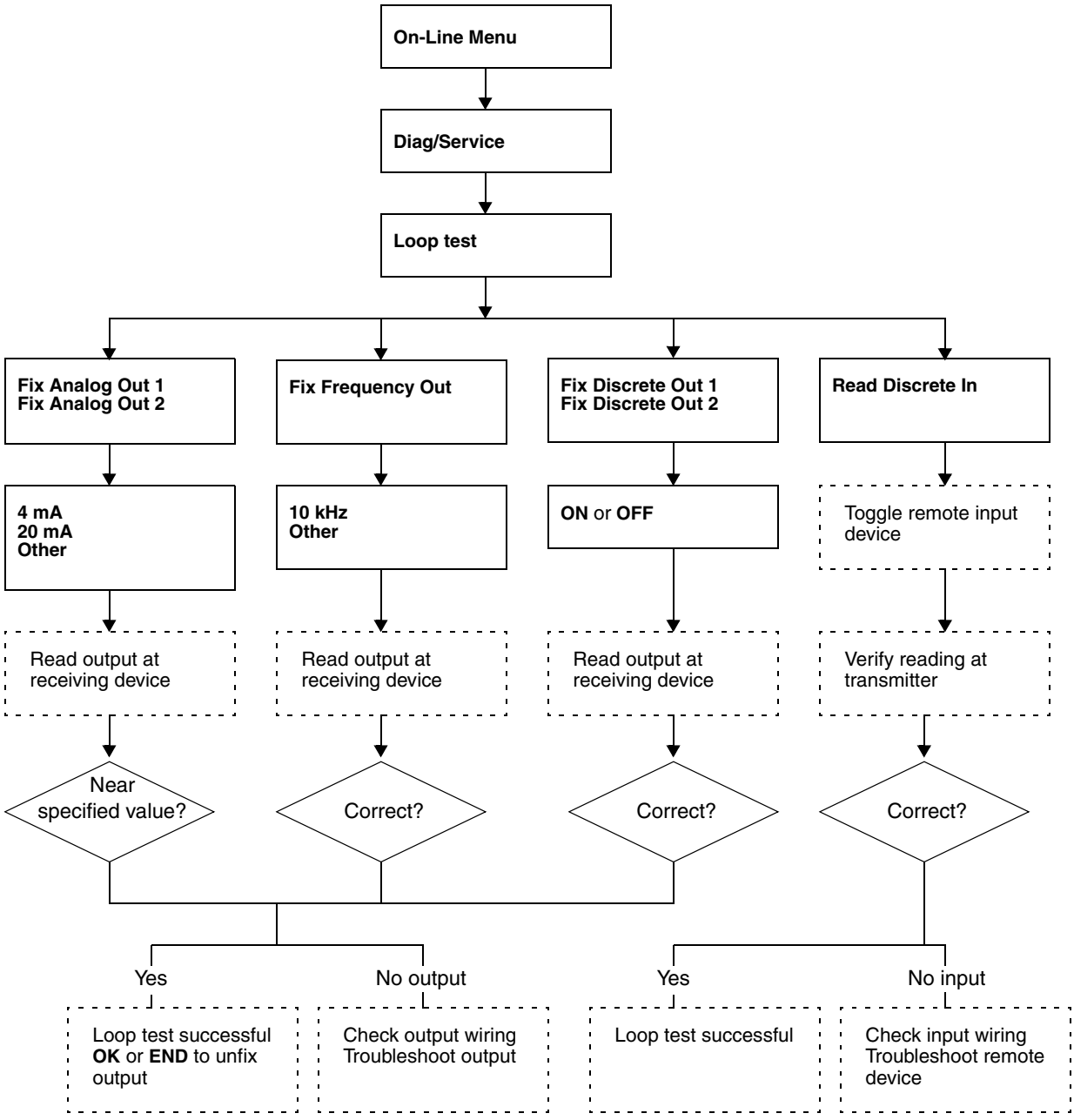
- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-4 for the loop test procedure. Not all options are available on all transmitters.

Note the following:

- If you are testing the primary mA output, the HART/Bell202 signal to the Communicator will affect the reading. Disconnect the Communicator before reading the output, then reconnect the Communicator and resume the loop test after taking the reading.
- The mA reading does not need to be exact. You will correct differences when you trim the mA output. See Section 5.4.

Figure 5-4 Communicator – Loop test procedure



5.4 Trimming the milliamp outputs

Trimming the mA output creates a common measurement range between the transmitter and the device that receives the mA output. For example, a transmitter might send a 4 mA signal that the receiving device reports incorrectly as 3.8 mA. If the transmitter output is trimmed correctly, it will send a signal appropriately compensated to ensure that the receiving device actually indicates a 4 mA signal.

You must trim the mA output at both the 4 mA and 20 mA points to ensure appropriate compensation across the entire output range.

Perform a milliamp trim on all mA outputs available on your transmitter. Before performing the trim, ensure that your transmitter terminals are configured for the input/outputs that will be used in your application (see Section 6.3).

You can trim the outputs with ProLink II or a Communicator.

5.4.1 Milliamp output trim with ProLink II

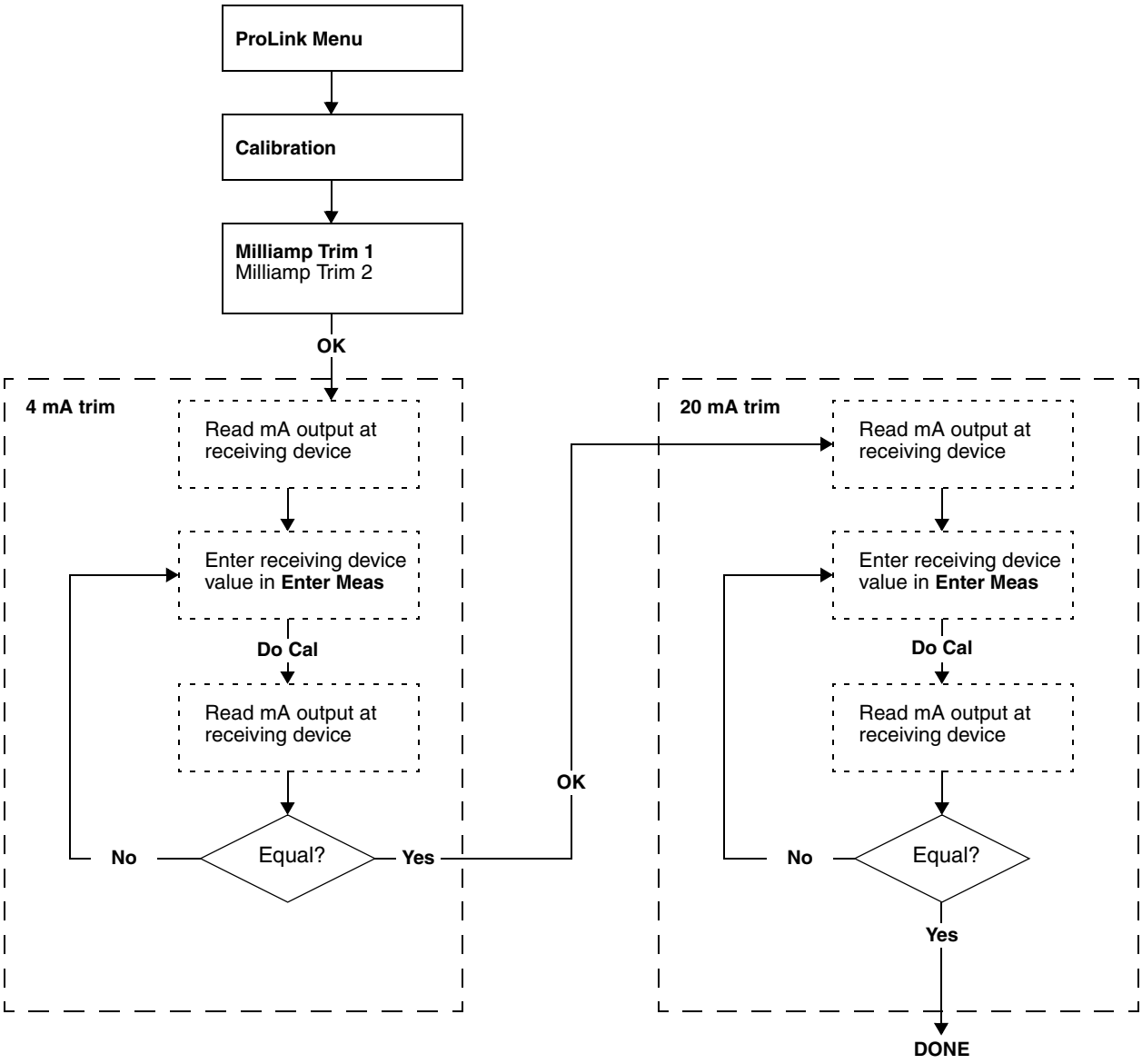
- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-5 for the mA output trim procedure.

Note the following:

- If you are trimming the primary mA output, and you are connected to the transmitter via HART/Bell202, the HART/Bell202 signal to ProLink II will affect the reading. Disconnect ProLink II before reading the output, then reconnect and resume the trim, after taking the reading. If you are using any other protocol, this is not required.
- Any trimming performed on the output should not exceed ± 200 microamps. If more trimming is required, contact Micro Motion customer support.

Figure 5-5 ProLink II – mA output trim procedure



5.4.2 Milliamp output trim with a Communicator

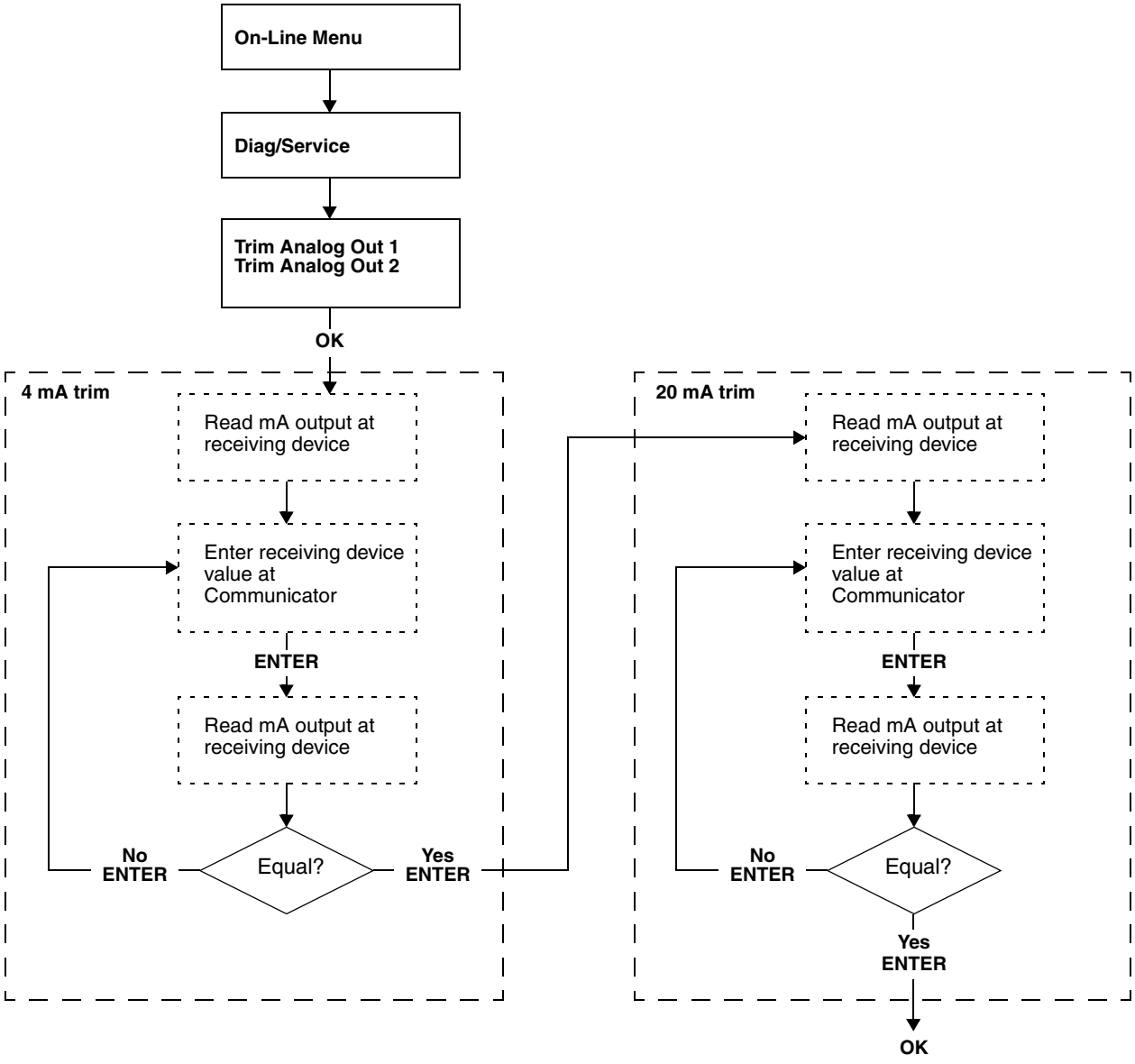
- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-6 for the mA output trim procedure.

Note the following:

- If you are trimming the primary mA output, the HART/Bell202 signal to the Communicator will affect the reading. Disconnect the Communicator before reading the output, then reconnect and resume the trim, after taking the reading.
- Any trimming performed on the output should not exceed ± 200 microamps. If more trimming is required, contact Micro Motion customer support.
- The receiving device value that you enter in the Communicator can contain up to two decimal places.

Figure 5-6 Communicator – mA output trim procedure



5.5 Zeroing the flowmeter

Zeroing the flowmeter establishes the flowmeter's point of reference when there is no flow.

When you zero the flowmeter, you may need to adjust the zero time parameter. *Zero time* is the amount of time the transmitter takes to determine its zero-flow reference point. The default zero time is 20 seconds.

- A *long* zero time may produce a more accurate zero reference but is more likely to result in a zero failure. This is due to the increased possibility of noisy flow, which causes incorrect calibration.
- A *short* zero time is less likely to result in a zero failure but may produce a less accurate zero reference.

For most applications, the default zero time is appropriate.

Note: In some menus, a convergence limit parameter is displayed. Micro Motion recommends that you use the default value for convergence limit.

Note: Do not zero the flowmeter if a high severity alarm is active. Correct the problem, then zero the flowmeter. You may zero the flowmeter if a low severity alarm is active. See Section 7.6 for information on viewing transmitter status and alarms.

You can zero the flowmeter with the display (if the transmitter has a display), ProLink II, the Communicator, or with the Zero button on the transmitter (Model 1500/2500 transmitters only).

If the zero procedure fails, see Section 10.6 for troubleshooting information.

5.5.1 Preparing for zero

To prepare for the zero procedure:

1. Apply power to the flowmeter. Allow the flowmeter to warm up for approximately 20 minutes.
2. Run the process fluid through the sensor until the sensor temperature reaches the normal process operating temperature.
3. Close the shutoff valve downstream from the sensor.
4. Ensure that the sensor is completely filled with fluid.
5. Ensure that the process flow has completely stopped.

⚠ CAUTION

If fluid is flowing through the sensor, the sensor zero calibration may be inaccurate, resulting in inaccurate process measurement.

To improve the sensor zero calibration and measurement accuracy, ensure that process flow through the sensor has completely stopped.

5.5.2 Zeroing with the display

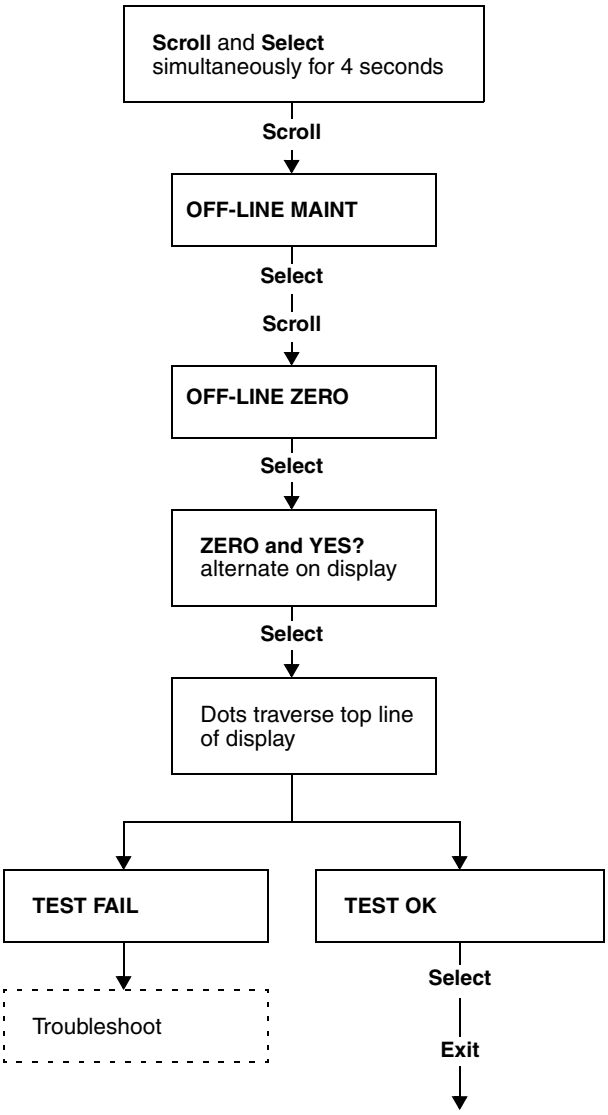
- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-7 for the flowmeter zero procedure.

Note the following:

- If the off-line menu has been disabled, you will not be able to zero the transmitter with the display. For information about enabling and disabling the off-line menu, see Section 8.14.1.
- You cannot change the zero time with the display. If you need to change the zero time, you must use the Communicator or ProLink II software.

Figure 5-7 Display – Flowmeter zero procedure

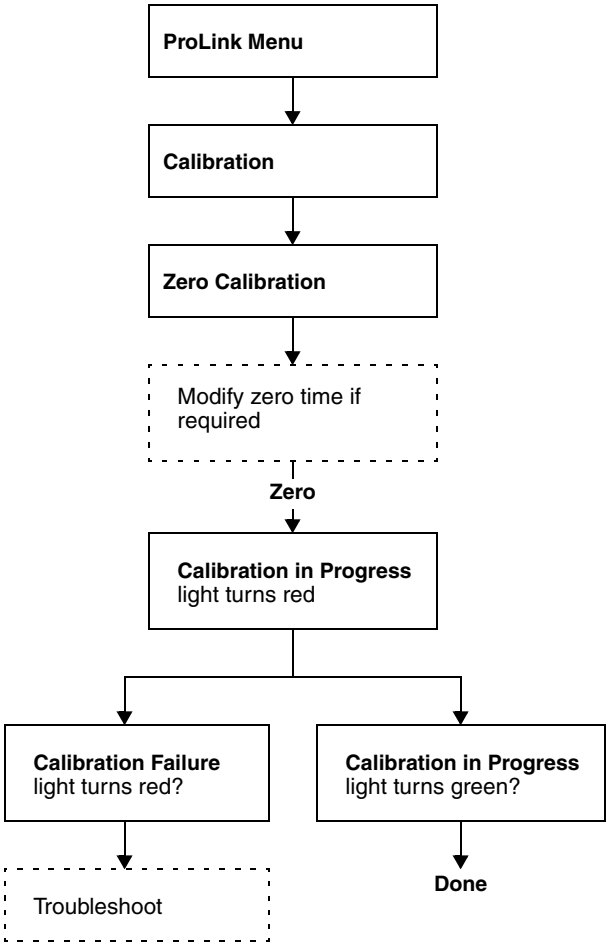


5.5.3 Zeroing with ProLink II

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-8 for the flowmeter zero procedure.

Figure 5-8 ProLink II – Flowmeter zero procedure

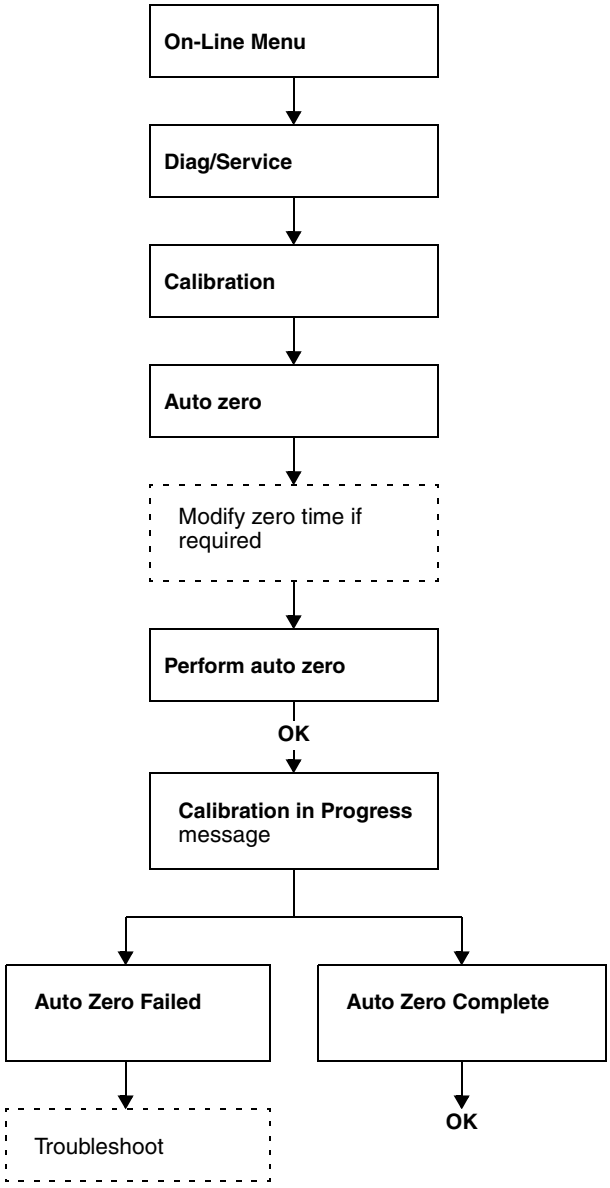


5.5.4 Zeroing with a Communicator

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

See Figure 5-9 for the flowmeter zero procedure.

Figure 5-9 Communicator – Flowmeter zero procedure



5.5.5 Zeroing with the Zero button

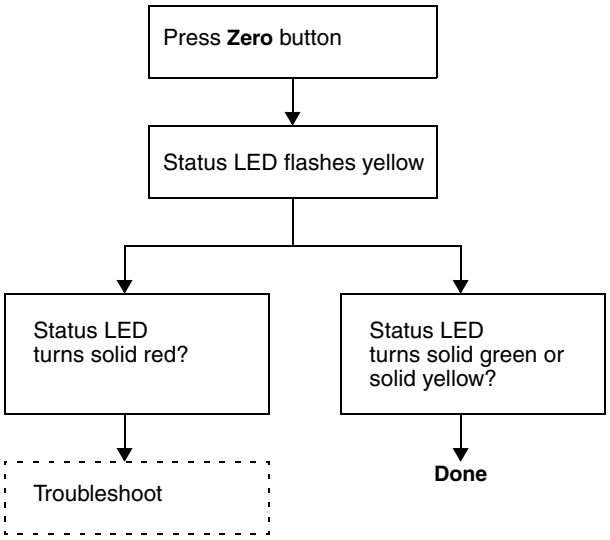
• Model 1500 AN
• Model 2500 CIO

See Figure 5-10 for the flowmeter zero procedure.

Note the following:

- You cannot change the zero time with the Zero button. If you need to change the zero time, you must use the Communicator or ProLink II software.
- The Zero button is located on the front panel of the transmitter. To press it, use a fine-pointed object such as the end of a paperclip. Hold the button down until the status LED on the front panel begins to flash yellow.

Figure 5-10 Zero button – Flowmeter zero procedure



Chapter 6
Required Transmitter Configuration

6.1 Overview

This chapter describes the configuration procedures that are usually required when a transmitter is installed for the first time.

The following procedures are discussed:

- Characterizing the flowmeter (see Section 6.2)
- Configuring transmitter terminals (see Section 6.3)
- Configuring measurement units (see Section 6.4)
- Configuring the mA output(s) (see Section 6.5)
- Configuring the frequency output (see Section 6.6)
- Configuring the discrete output (see Section 6.7)
- Configuring the discrete input (see Section 6.7.1)

This chapter provides basic flowcharts for each procedure. For more detailed flowcharts, see the flowcharts for your transmitter and communication tool, provided in the appendices to this manual.

Default values and ranges for the parameters described in this chapter are provided in Appendix A.

For optional transmitter configuration parameters and procedures, see Chapter 8.

Note: All ProLink II procedures provided in this chapter assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Chapter 3 for more information.

Note: If you are using AMS, the AMS interface will be similar to the ProLink II interface described in this chapter.

Note: All Communicator procedures provided in this chapter assume that you are starting from the "Online" menu. See Chapter 4 for more information.

6.2 Characterizing the flowmeter

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Characterizing the flowmeter adjusts the transmitter to compensate for the unique traits of the sensor it is paired with. The characterization parameters, or calibration parameters, describe the sensor's sensitivity to flow, density, and temperature.

6.2.1 When to characterize

If the transmitter, core processor, and sensor were ordered together, then the flowmeter has already been characterized. You need to characterize the flowmeter only if the core processor and sensor are being paired together for the first time.

6.2.2 Characterization parameters

The characterization parameters that must be configured depend on your flowmeter's sensor type: "T-Series" or "Other" (also referred to as "Straight Tube" and "Curved Tube," respectively), as listed in Table 6-1. The "Other" category includes all Micro Motion sensors except T-Series.

The characterization parameters are provided on the sensor tag. The format of the sensor tag varies depending on your sensor's date of purchase. See Figures 6-1 and 6-2 for illustrations of newer and older sensor tags.

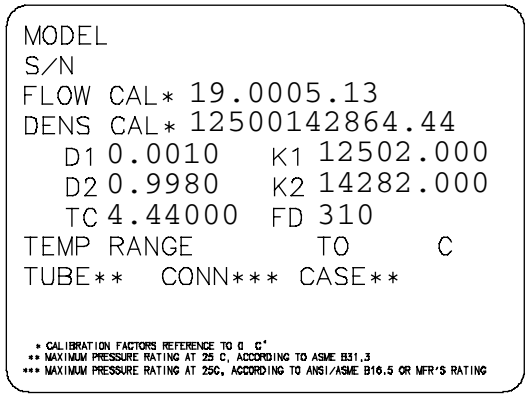
Table 6-1 Sensor calibration parameters

	Sensor type	
Parameter	**T-Series**	**Other**
K1	✓	✓✈✉
K2	✓	✓(1)
FD	✓	✓(1)
D1	✓	✓(1)
D2	✓	✓(1)
Temp coeff (DT)(2)	✓	✓(1)
Flowcal		✓(3)
FCF and FT	✓(4)	
FCF	✓✈✕✉	
FTG	✓	
FFQ	✓	
DTG	✓	
DFQ1	✓	
DFQ2	✓	

(1) See the section entitled "Density calibration factors."
(2) On some sensor tags, shown as TC.
(3) See the section entitled "Flow calibration values."
(4) Older T-Series sensors. See the section entitled "Flow calibration values."
(5) Newer T-Series sensors. See the section entitled "Flow calibration values."

Figure 6-1 Sample calibration tags – All sensors except T-Series

Newer tag


MODEL
S/N
FLOW CAL* 19.0005.13
DENS CAL* 12500142864.44
D1 0.0010 K1 12502.000
D2 0.9980 K2 14282.000
TC 4.44000 FD 310
TEMP RANGE TO C
TUBE** CONN*** CASE**
* CALIBRATION FACTORS REFERENCE TO C
** MAXIMUM PRESSURE RATING AT 25 C, ACCORDING TO ASME B31.3
*** MAXIMUM PRESSURE RATING AT 25C, ACCORDING TO ANSI/ASME B16.5 OR MFR'S RATING

Older tag

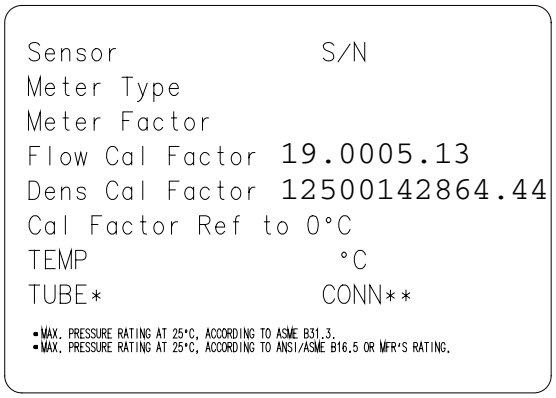
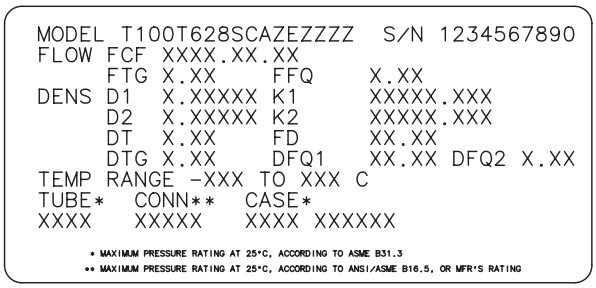
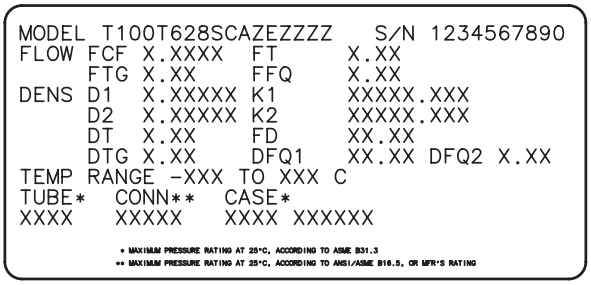

Sensor S/N
Meter Type
Meter Factor
Flow Cal Factor 19.0005.13
Dens Cal Factor 12500142864.44
Cal Factor Ref to 0°C
TEMP °C
TUBE* CONN**
*MAX. PRESSURE RATING AT 25°C, ACCORDING TO ASME B31.3.
*MAX. PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5 OR MFR'S RATING.

Figure 6-2 Sample calibration tags – T-Series sensors

Newer tag


MODEL T100T628SCAZEZZZZ S/N 1234567890
FLOW FCF XXXX.XX.XX
FTG X.XX FFQ X.XX
DENS D1 X.XXXXX K1 XXXXX.XXX
D2 X.XXXXX K2 XXXXX.XXX
DT X.XX FD XX.XX
DTG X.XX DFQ1 XX.XX DFQ2 X.XX
TEMP RANGE -XXX TO XXX C
TUBE* CONN** CASE*
XXXX XXXXX XXXX XXXXXX
* MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ASME B31.3
** MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5, OR MFR'S RATING

Older tag


MODEL T100T628SCAZEZZZZ S/N 1234567890
FLOW FCF X.XXXX FT X.XX
FTG X.XX FFQ X.XX
DENS D1 X.XXXXX K1 XXXXX.XXX
D2 X.XXXXX K2 XXXXX.XXX
DT X.XX FD XX.XX
DTG X.XX DFQ1 XX.XX DFQ2 X.XX
TEMP RANGE -XXX TO XXX C
TUBE* CONN** CASE*
XXXX XXXXX XXXX XXXXXX
* MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ASME B31.3
** MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5, OR MFR'S RATING

Density calibration factors

If your sensor tag does not show a D1 or D2 value:

- For D1, enter the Dens A or D1value from the calibration certificate. This value is the line-condition density of the low-density calibration fluid. Micro Motion uses air.
- For D2, enter the Dens B or D2 value from the calibration certificate. This value is the line-condition density of the high-density calibration fluid. Micro Motion uses water.

If your sensor tag does not show a K1 or K2 value:

- For K1, enter the first 5 digits of the density calibration factor. In the sample tag in Figure 6-1, this value is shown as **12500**.
- For K2, enter the second 5 digits of the density calibration factor. In the sample tag in Figure 6-1, this value is shown as **14286**.

If your sensor does not show an FD value, contact Micro Motion customer service.

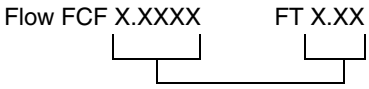
If your sensor tag does not show a DT or TC value, enter the last 3 digits of the density calibration factor. In the sample tag in Figure 6-1, this value is shown as **4.44**.

Flow calibration values

Two separate values are used to describe flow calibration: a 6-character FCF value and a 4-character FT value. Both values contain decimal points. During characterization, these are entered as a single 10-character string that includes two decimal points. In ProLink II, this value is called the Flowcal parameter; in the Communicator, it is called the FCF for T-Series sensors, and Flowcal for other sensors.

To obtain the required value:

- For older T-Series sensors, concatenate the FCF value and the FT value from the sensor tag, as shown below.



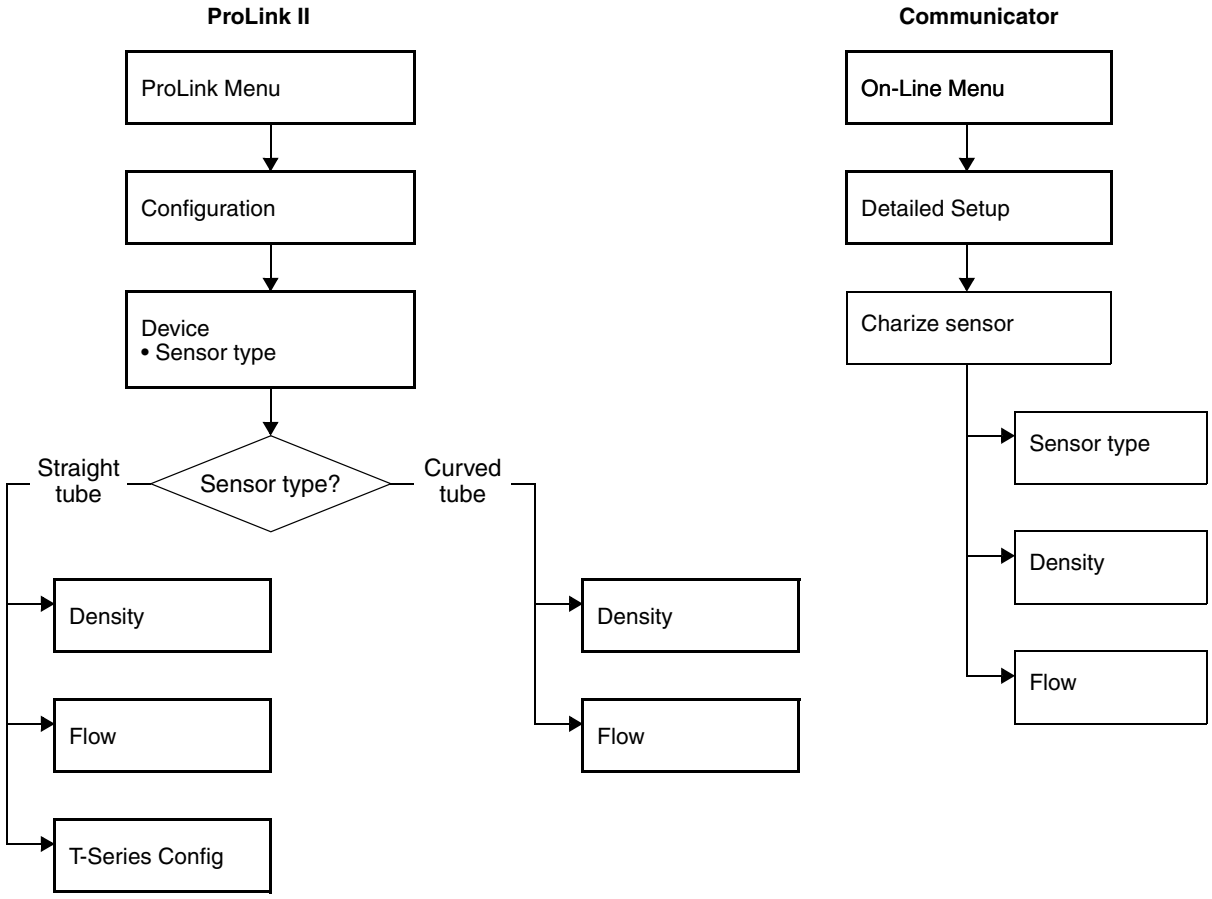
- For newer T-Series sensors, the 10-character string is represented on the sensor tag as the FCF value. The value should be entered exactly as shown, including the decimal points. No concatenation is required.
- For all other sensors, the 10-character string is represented on the sensor tag as the Flow Cal value. The value should be entered exactly as shown, including the decimal points. No concatenation is required.

6.2.3 How to characterize

To characterize the flowmeter:

1. See the menu flowcharts in Figure 6-3.
2. Ensure that the correct sensor type is configured.
3. Set required parameters, as listed in Table 6-1.

Figure 6-3 Characterizing the flowmeter



6.3 Configuring transmitter terminals

• Model 2500 CIO
• Model 2700 AN
• Model 2700 IS
• Model 2700 CIO

Configuration of the transmitter terminals has consequences for many following configuration options. Therefore, it is important to configure or verify terminal configuration at the beginning of transmitter configuration.

- If you have a Model 2500 or Model 2700 transmitter with the configurable input/output board, you must configure the channels.
- If you have a Model 2700 transmitter with the analog or intrinsically safe output board, you must specify whether terminals 3 & 4 will operate as a frequency output (FO) or a discrete output (DO).

6.3.1 Configuring the channels

• Model 2500 CIO
• Model 2700 CIO

The six input/output terminals provided on these transmitters are organized into three pairs, or sets. These pairs are called Channels A, B, and C.

The outputs and variable assignments that you can configure are controlled by the channel configuration. Table 6-2 shows how each channel may be configured, to what default variable each configuration is set, and the power options for each channel.

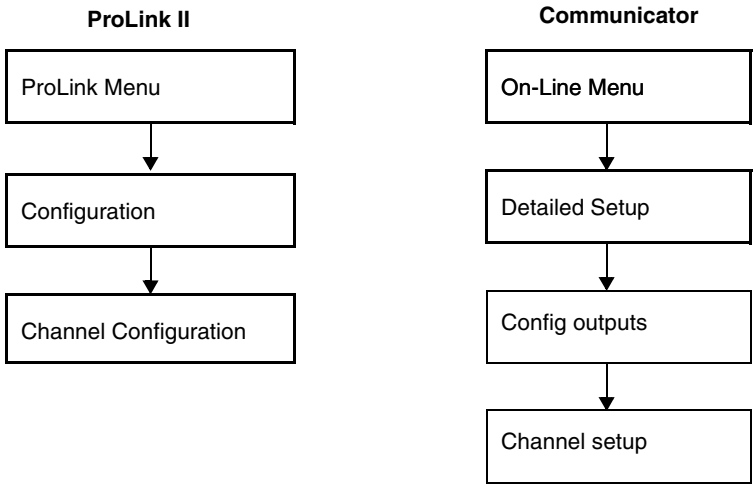
Table 6-2 Channel configuration options

Channel	Terminals 2500	Terminals 2700	Configuration Option	Default Process Variable Assignment	Power
A	21 & 22	1 & 2	mA output 1 (with Bell 202 HART)	Mass flow	Internal
B	23 & 24	3 & 4	mA output 2 (default)(1)	Density	Internal or external(2)
			Frequency output (FO)	Mass flow	
			Discrete output 1 (DO1)(3)	Fwd/Rev	
C	31 & 32	5 & 6	FO (default)(3)(4)	Mass flow	Internal or external(2)
			Discrete output 2 (DO2)	Flow switch	
			Discrete input (DI)	None	

(1) If set to MAO2, internal power is required.
(2) If set to external power, you must provide power to the outputs.
(3) Because DO1 uses the same circuitry as the frequency output, it is not possible to configure both FO and DO1. If both a frequency output and a discrete output are required, configure Channel B as the FO and Channel C as DO2.
(4) When configured for two FOs (dual pulse), FO2 is generated from the same FO signal sent to the first FO. FO2 is electrically isolated but not independent.

To configure the channels, see the menu flowcharts in Figure 6-4.

Figure 6-4 Configuring the channels



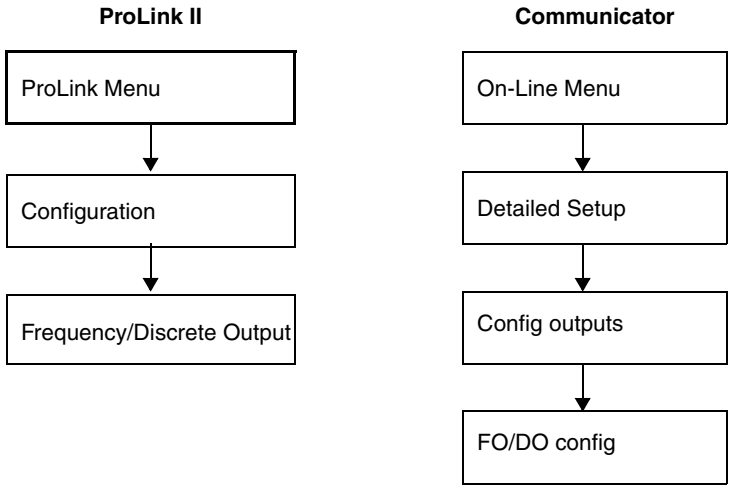
6.3.2 Configuring terminals 3 & 4

- Model 2700 AN
- Model 2700 IS

On these transmitters, terminals 3 & 4 can operate as a frequency output (FO) or a discrete output (DO). The default is FO.

To configure the terminals, see the menu flowcharts in Figure 6-5.

Figure 6-5 Configuring terminals 3 & 4



6.4 Configuring the measurement units

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

For each process variable, the transmitter must be configured to use the measurement unit appropriate to your application.

For some transmitters, the density and temperature process variables can be viewed but cannot be assigned to an output. See Table 6-3.

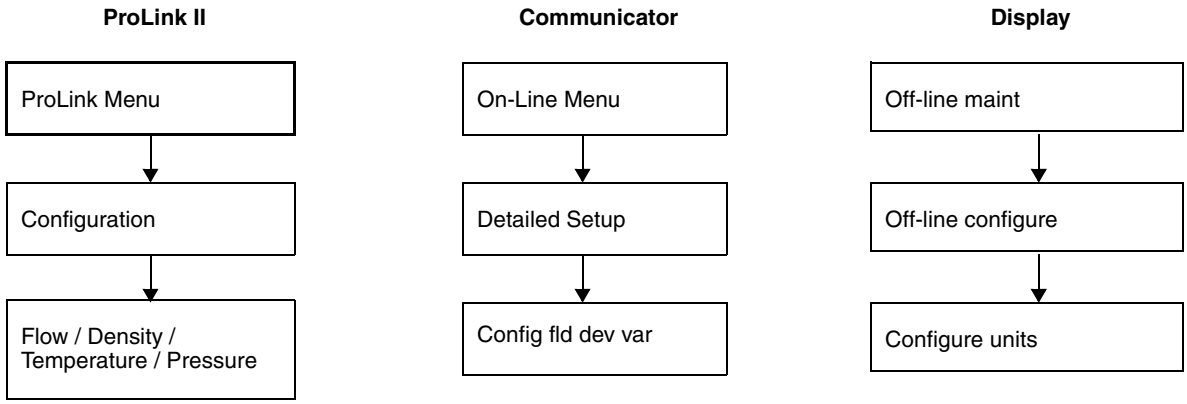
Table 6-3 Transmitter models and available process variables

Transmitter	Mass flow	Volume flow	Density	Temperature
Model 1500 AN	✓	✓	✓(1)	✓(1)
Model 1700 AN	✓	✓	✓(1)	✓(1)
Model 1700 IS	✓	✓	✓(1)	✓(1)
Model 2500 CIO	✓	✓	✓	✓
Model 2700 AN	✓	✓	✓	✓
Model 2700 IS	✓	✓	✓	✓
Model 2700 CIO	✓	✓	✓	✓

(1) Can be viewed, but cannot be assigned to an output.

To configure measurement units, see the menu flowcharts in Figure 6-6. For details on measurement units for each process variable, see Sections 6.4.1 through 6.4.4.

Figure 6-6 Configuring measurement units



6.4.1 Mass flow units

The default mass flow measurement unit is **g/s**. See Table 6-4 for a complete list of mass flow measurement units.

If the mass flow unit you want to use is not listed, you can define a special measurement unit for mass flow (see Section 8.4).

Table 6-4 Mass flow measurement units

Mass flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
G/S	g/s	g/s	Grams per second
G/MIN	g/min	g/min	Grams per minute
G/H	g/hr	g/h	Grams per hour
KG/S	kg/s	kg/s	Kilograms per second
KG/MIN	kg/min	kg/min	Kilograms per minute
KG/H	kg/hr	kg/h	Kilograms per hour
KG/D	kg/day	kg/d	Kilograms per day
T/MIN	mTon/min	MetTon/min	Metric tons per minute
T/H	mTon/hr	MetTon/h	Metric tons per hour
T/D	mTon/day	MetTon/d	Metric tons per day
LB/S	lbs/s	lb/s	Pounds per second
LB/MIN	lbs/min	lb/min	Pounds per minute
LB/H	lbs/hr	lb/h	Pounds per hour
LB/D	lbs/day	lb/d	Pounds per day
ST/MIN	sTon/min	STon/min	Short tons (2000 pounds) per minute
ST/H	sTon/hr	STon/h	Short tons (2000 pounds) per hour
ST/D	sTon/day	STon/d	Short tons (2000 pounds) per day
LT/H	lTon/hr	LTon/h	Long tons (2240 pounds) per hour
LT/D	lTon/day	LTon/d	Long tons (2240 pounds) per day
SPECL	special	Spcl	Special unit (see Section 8.4)

6.4.2 Volume flow units

The default volume flow measurement unit is **L/s**. See Table 6-5 for a complete list of volume flow measurement units.

If the volume flow unit you want to use is not listed, you can define a special measurement unit for volume flow (see Section 8.4).

Table 6-5 Volume flow measurement units

Volume flow unit			
Display	**ProLink II**	**Communicator**	**Unit description**
CUFT/S	ft3/sec	Cuft/s	Cubic feet per second
CUF/MN	ft3/min	Cuft/min	Cubic feet per minute
CUFT/H	ft3/hr	Cuft/h	Cubic feet per hour
CUFT/D	ft3/day	Cuft/d	Cubic feet per day
M3/S	m3/sec	Cum/s	Cubic meters per second
M3/MIN	m3/min	Cum/min	Cubic meters per minute
M3/H	m3/hr	Cum/h	Cubic meters per hour
M3/D	m3/day	Cum/d	Cubic meters per day
USGPS	US gal/sec	gal/s	U.S. gallons per second
USGPM	US gal/min	gal/min	U.S. gallons per minute
USGPH	US gal/hr	gal/h	U.S. gallons per hour
USGPD	US gal/d	gal/d	U.S. gallons per day
MILG/D	mil US gal/day	MMgal/d	Million U.S. gallons per day
L/S	l/sec	L/s	Liters per second
L/MIN	l/min	L/min	Liters per minute
L/H	l/hr	L/h	Liters per hour
MILL/D	mil l/day	ML/d	Million liters per day
UKGPS	Imp gal/sec	Impgal/s	Imperial gallons per second
UKGPM	Imp gal/min	Impgal/min	Imperial gallons per minute
UKGPH	Imp gal/hr	Impgal/h	Imperial gallons per hour
UKGPD	Imp gal/day	Impgal/d	Imperial gallons per day
BBL/S	barrels/sec	bbl/s	Barrels per second(1)
BBL/MN	barrels/min	bbl/min	Barrels per minute(1)
BBL/H	barrels/hr	bbl/h	Barrels per hour(1)
BBL/D	barrelsday	bbl/d	Barrels per day(1)
SPECL	special	Spcl	Special unit (see Section 8.4)

(1) Unit based on oil barrels (42 U.S gallons).

6.4.3 Density units

The default density measurement unit is **g/cm3**. See Table 6-4 for a complete list of density measurement units.

Table 6-6 Density measurement units

Density unit			
Display	**ProLink II**	**Communicator**	**Unit description**
SGU	SGU	SGU	Specific gravity unit (not temperature corrected)
G/CM3	g/cm3	g/Cucm	Grams per cubic centimeter
G/L	g/l	g/L	Grams per liter
G/ML	g/ml	g/mL	Grams per milliliter
KG/L	kg/l	kg/L	Kilograms per liter
KG/M3	kg/m3	kg/Cum	Kilograms per cubic meter
LB/GAL	lbs/Usgal	lb/gal	Pounds per U.S. gallon
LB/CUF	lbs/ft3	lb/Cuft	Pounds per cubic foot
LB/CUI	lbs/in3	lb/CuIn	Pounds per cubic inch
Not configurable	degAPI	degAPI	API gravity (API feature only)
ST/CUY	sT/yd3	STon/Cuyd	Short ton per cubic yard

6.4.4 Temperature units

The default temperature measurement unit is **degC**. See Table 6-7 for a complete list of temperature measurement units.

Table 6-7 Temperature measurement units

Temperature unit			
Display	**ProLink II**	**Communicator**	**Unit description**
°C	degC	degC	Degrees Celsius
°F	degF	degF	Degrees Fahrenheit
°R	degR	degR	Degrees Rankine
°K	degK	Kelvin	Degrees Kelvin

6.5 Configuring the mA output(s)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

All transmitters have one mA output, called the primary mA output. Some transmitters always have a secondary mA output, and some transmitters can be configured for a secondary mA output (see Section 6.3, page 47). The menu options for the secondary mA output will appear only if a secondary mA output is present on your transmitter.

Note: Configure the transmitter for the required input/output types before configuring individual outputs. See Section 6.3.

The following parameters must be set for the primary mA output, and for the secondary mA output if it is present:

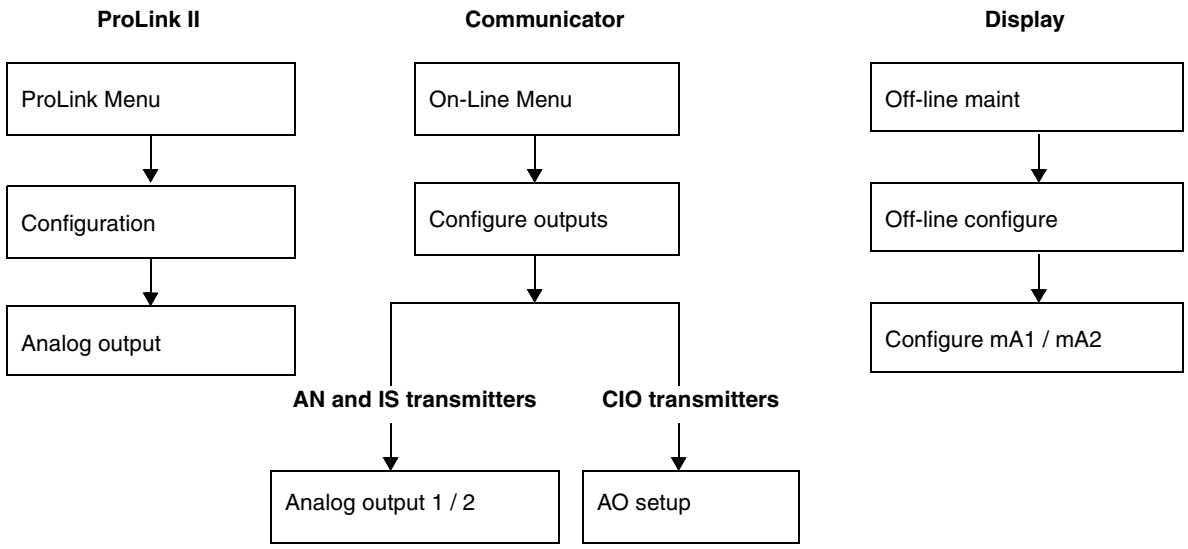
- Process variable
- Upper range value (URV) and lower range value (LRV)
- AO (analog output) cutoff
- Fault indicator and fault value

An additional parameter—added damping—can be configured if required.

To configure the mA outputs, see the menu flowcharts in Figure 6-6. For details on mA output parameters, see Sections 6.5.1 through 6.5.5.

Note: If you use the display to configure the mA output, you can configure only the process variable and the range. To configure other mA output parameters, use ProLink II or the Communicator.

Figure 6-7 Configuring the mA output(s)



6.5.1 Configuring the process variable

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

You can configure the process variables to be reported through the mA outputs. Table 6-8 lists the process variables that can be assigned to the primary and secondary mA outputs.

Note: Some transmitters can measure only mass flow and volume flow. See Table 6-3.

Note: If the enhanced density or petroleum measurement application is installed on your transmitter, additional process variables will be available for assignment.

Table 6-8 mA output process variable assignments

Process variable(1)	ProLink II code	Communicator code	Display code
Mass flow	Mass Flow	Mass flo	MFLOW
Volume flow	Vol Flow	Vol flo	VFLOW
Temperature	Temp	Temp	TEMPR
Density	Density	Dens	DENS
Temperature-corrected density(2)	Dens at Ref	TC Dens	TCDEN
Temperature-corrected (standard) volume flow(2)	Std Vol Flow	TC Vol	TCVOL
Drive gain	Drive Gain	Driv signl	DGAIN
Average corrected density(2) (3)	Avg Corr Density		AVE_D
Average temperature(2) (3)	Avg Temp		AVE_T

(1) If the enhanced density application is enabled, enhanced density process variables are also available.
(2) Available only if the petroleum measurement application is enabled on your transmitter.
(3) Requires rev3.3 or later of the transmitter software. Can be configured only with the display or with v1.2 or later of ProLink II software.

Note: The process variable assigned to the primary mA output is always the PV (primary variable) defined for HART communications. You can specify this process variable either by configuring the primary mA output or by configuring the PV (see Section 8.15.6). If you change the process variable assigned to the mA output, the PV assignment is changed automatically, and vice versa.

If your transmitter has a secondary mA output, the process variable assigned to it is always the SV (secondary variable) defined for HART communications. You can specify this process variable either by configuring the secondary mA output or by configuring the SV (see Section 8.15.6). If you change the process variable assigned to the mA output, the SV assignment is changed automatically, and vice versa.

If your transmitter does not have a secondary mA output, the SV assignment must be configured directly (see Section 8.15.6), and the value of the SV must be queried through an RS-485 connection, read through the Communicator, or reported through burst mode.

6.5.2 Configuring the mA output range (LRV and URV)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The mA outputs use a range of 4 to 20 mA to represent the assigned process variable. You must specify:

- The lower range value (LRV) – the value of the process variable that will be indicated when the mA output produces 4 mA
- The upper range value (URV) – the value of the process variable that will be indicated when the mA output produces 20 mA

Enter values in the measurement units that are configured for the assigned process variable (see Section 6.4).

Note: The URV can be set below the LRV; for example, the URV can be set to 0 and the LRV can be set to 100.

6.5.3 Configuring the AO cutoff(s)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The AO (analog output) cutoff specifies the lowest mass flow or volume flow value that will be reported through the mA output. Any mass flow or volume flow values below the AO cutoff will be reported as zero.

AO cutoff can be configured only if the process variable assigned to the mA output is mass flow or volume flow. If an mA output has been configured for a process variable other than mass flow or volume flow, the AO cutoff menu option is not displayed for that output.

Note: For most applications, the default AO cutoff is used. Contact Micro Motion customer support before changing the AO cutoff.

Multiple cutoffs

Cutoffs can also be configured for the mass flow and volume flow process variables (see Section 8.6). If mass flow or volume flow has been assigned to an mA output, a non-zero value is configured for the flow cutoff, and the AO cutoff is also configured, the cutoff occurs at the highest setting, as shown in the following examples.

Example

Configuration:

- Primary mA output: Mass flow
- Frequency output: Mass flow
- AO cutoff for primary mA output: 10 g/sec
- Mass flow cutoff: 15 g/sec

As a result, if the mass flow rate drops below 15 g/sec, all outputs representing mass flow will report zero flow.

Example

Configuration:

- Primary mA output: Mass flow
- Frequency output: Mass flow
- AO cutoff for primary mA output: 15 g/sec
- Mass flow cutoff: 10 g/sec

As a result:

- If the mass flow rate drops below 15 g/sec but not below 10 g/sec:
  - The primary mA output will report zero flow.
  - The frequency output will report nonzero flow.
- If the mass flow rate drops below 10 g/sec, both outputs will report zero flow.

6.5.4 Configuring the fault indicator and fault value

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If the transmitter encounters an internal fault condition, it will indicate the fault by sending a preprogrammed output level to the receiving device. You can specify the output level by configuring the fault indicator. Options are shown in Table 6-9.

Note: By default, the transmitter immediately reports a fault when a fault is encountered. You can delay reporting faults by changing the fault timeout. See Section 8.12.

Table 6-9 mA output fault indicators and values

Fault indicator	Fault output value
Upscale	21–24 mA (default: 22 mA)
Downscale	IS transmitters: 3.2–3.6 mA (default: 3.2 mA) All other transmitters: 1.0–3.6 mA (default: 2.0 mA)
Internal zero	The value associated with 0 (zero) flow, as determined by URV and LRV values
None	Tracks data for the assigned process variable; no fault action

⚠ CAUTION

Setting the fault indicator to NONE may result in process error due to undetected fault conditions.

To avoid undetected fault conditions when the fault indicator is set to NONE, use some other mechanism such as digital communication to monitor device status.

6.5.5 Configuring added damping

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

A *damping* value is a period of time, in seconds, over which the process variable value will change to reflect 63% of the change in the actual process. Damping helps the transmitter smooth out small, rapid measurement fluctuations:

- A high damping value makes the output appear to be smoother because the output must change slowly.
- A low damping value makes the output appear to be more erratic because the output changes more quickly.

The added damping parameter specifies damping that will be applied to the mA output. It affects the measurement of the process variable assigned to the mA output, but does not affect the frequency or digital outputs.

Note: For most applications, the default added damping value is used. Contact Micro Motion customer support before changing the added damping parameter.

Multiple damping parameters

Damping can also be configured for the flow (mass and volume), density, and temperature process variables (see Section 8.7). If one of these process variables has been assigned to an mA output, a non-zero value is configured for its damping, and added damping is also configured for the mA output, the effect of damping the process variable is calculated first, and the added damping calculation is applied to the result of that calculation. See the following example.

Example

Configuration:

- Flow damping: 1
- Primary mA output: Mass flow
- Frequency output: Mass flow
- Primary mA output added damping: 2

As a result:

- A change in mass flow will be reflected in the primary mA output over a time period that is greater than 3 seconds. The exact time period is calculated by the transmitter according to internal algorithms which are not configurable.
- The frequency output level changes over a 1–second time period (the mass flow damping value). It is not affected by the added damping value.

6.6 Configuring the frequency output(s)

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Different transmitters have different frequency output options. See Section 6.3 for information on configuring your transmitter's outputs.

Note: Configure the transmitter for the required input/output types before configuring individual outputs. See Section 6.3.

The frequency output generates two voltage levels:

- 0 V
- A site-specific voltage, determined by the power supply, pull-up resistor, and load (see the installation manual for your transmitter)

If your transmitter is configured for two frequency outputs (Model 2500 CIO and Model 2700 CIO transmitters only), the Channel C signal is generated from the Channel B signal, with a user-specified phase shift. The signals are electrically isolated but not independent. You cannot configure Channel B and Channel C independently.

Note: Configuring both Channel B and Channel C as frequency outputs is used to enable dual pulse or quadrature mode (see Section 6.6.5).

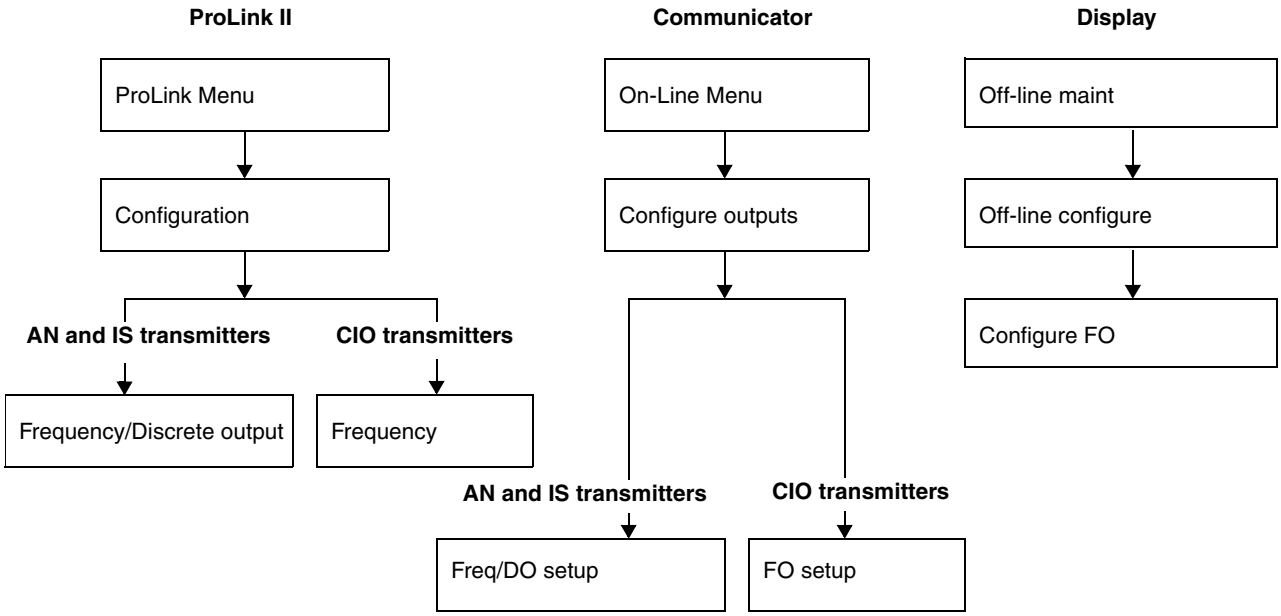
If a frequency output is present on your transmitter, the following parameters must be set:

- Process variable
- Output scale
- Pulse width
- Polarity
- Mode (Model 2500 and Model 2700 only, if two frequency outputs have been configured)
- Fault indicator

To configure the frequency output, see the menu flowcharts in Figure 6-6. For details on mA output parameters, see Sections 6.6.1 through 6.6.5.

Note: If you use the display to configure the frequency output, you can configure only the process variable and the Frequency = flow output scale. To configure other frequency output parameters, use ProLink II or the Communicator.

Figure 6-8 Configuring the frequency output(s)



6.6.1 Configuring the process variable

- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

With a Series 1000 transmitter, the frequency output assignment is controlled by the primary mA output assignment. If mass flow or volume flow is assigned to the primary mA output, the same process variable is assigned to the frequency output.

With a Series 2000 transmitter, the frequency output is independent of the primary mA output. Table 6-10 lists the process variables that can be assigned to the frequency output.

Table 6-10 Frequency output process variable assignments for Series 2000 transmitters

Process variable[1]	ProLink II code	Communicator code	Display code
Mass flow	Mass Flow	Mass flo	MFLOW
Volume flow	Vol Flow	Vol flo	VFLOW
Temperature-corrected (standard) volume flow[2]	Std Vol Flow	TC Vol	TCVOL

(1) If the enhanced density application is enabled, enhanced density process variables are also available.
(2) Available only if the petroleum measurement application is enabled on your transmitter.

Note: The process variable assigned to the frequency output is always the TV (tertiary variable) defined for HART communications. You can specify this process variable either by configuring the frequency output or by configuring the TV (see Section 8.15.6). If you change the process variable assigned to the mA output, the TV assignment is changed automatically, and vice versa.

If your transmitter does not have a frequency output, the TV assignment must be configured directly (see Section 8.15.6), and the value of the TV must be queried through an RS-485 connection, read through the Communicator, or reported through burst mode.

6.6.2 Configuring the output scale

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The frequency *output scale* defines the relationship between output pulse and flow units. You can select one of three output scale methods, as listed in Table 6-11.

Table 6-11 Frequency output scale methods and required parameters

Method	Description	Required parameters
Frequency = flow	• Frequency calculated from flow rate as described below	• *TV frequency factor* • *TV rate factor*
Pulses per unit	• A user-specified number of pulses represents one flow unit	• *TV pulses/unit*
Units per pulse	• A pulse represents a user-specified number of flow units	• *TV units/pulse*

Frequency=flow

If you specify **Frequency = flow**, you must also specify **TV frequency factor** and **TV rate factor**. **TV rate factor** is defined as the maximum flowrate appropriate to your application. **TV frequency factor** can then be calculated using the following formula:

$$\text{FrequencyFactor} = \frac{\text{Rate}}{\text{T}} \times \text{N}$$

where:

- Rate = maximum appropriate flowrate (**TV rate factor** in configuration)
- T = factor to convert selected flow time base to seconds
- N = number of pulses per flow unit, as configured in the receiving device

The resulting **TV frequency factor** value must be within the range of the frequency output (0 to 10,000 Hz).

- If the **TV frequency factor** value is less than 1 Hz, reconfigure the receiving device for a higher pulses/unit setting.
- If the **TV frequency factor** value is greater than 10,000 Hz, reconfigure the receiving device for a lower pulses/unit setting.

Example

Maximum appropriate flowrate (**TV rate factor**) is 2000 lbs/min.

Receiving device is configured for 10 pulses/pound.

Solution:

$$\text{FrequencyFactor} = \frac{\text{Rate}}{\text{T}} \times \text{N}$$

$$\text{FrequencyFactor} = \frac{2000}{60} \times 10$$

$$\text{FrequencyFactor} = 333.33$$

Configuration:

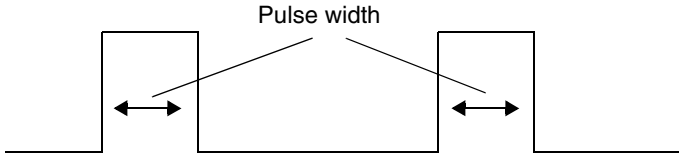
- TV frequency factor = 333.33
- TV rate factor = 2000

6.6.3 Configuring the maximum pulse width

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The frequency output *maximum pulse width* defines the maximum duration of each pulse the transmitter sends to the frequency receiving device, as shown in Figure 6-9.

Figure 6-9 Pulse width



The pulse width is configurable to values between 0 and 277 milliseconds.

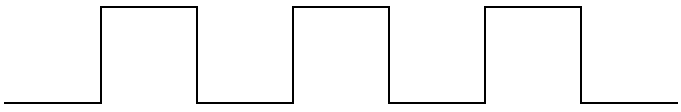
As the frequency increases, at some point the pulse width will become equivalent to the desired output frequency. This frequency is called the *crossover frequency*, and is calculated as follows:

$$\text{Crossover frequency} = \frac{1}{2 \times \text{max pulse width}}$$

Note: Although you can set maximum pulse width to 0, it is not useful because it will result in an undefined crossover frequency.

At frequencies above the crossover frequency, the output changes to a 50% duty cycle as shown in Figure 6-10.

Figure 6-10 50% duty cycle



The default pulse width is 277 milliseconds, which yields a crossover frequency of 1.8 Hz. In other words, above 1.8 Hz, the transmitter's frequency output will use a 50% duty cycle. At frequencies of 1.8 Hz or lower, the pulse width will be 277 ms. In both cases, the process variable is represented by the number of pulses per unit of time.

The transmitter's maximum crossover frequency is 922 Hz. This corresponds to a pulse width of 0.543 ms.

You can change the setting for maximum pulse width so that the transmitter will output a pulse width appropriate to your receiving device:

- High-frequency counters such as frequency-to-voltage converters, frequency-to-current converters, and Micro Motion peripherals usually require approximately a 50% duty cycle.
- Electromechanical counters and PLCs that have low-scan cycle rates generally use an input with a fixed nonzero state duration and a varying zero state duration. Most low-frequency counters have a specified requirement for the maximum pulse width.

Note: For typical applications, the default pulse width is used.

Example

The frequency output is wired to a PLC with a specified pulse width requirement of 50 ms. The crossover frequency is 10 Hz.

Solution:

- Set Max Pulse Width to 50 ms.
- For frequencies less than 10 Hz, the frequency output will have a 50 msec ON state, and the OFF state will be adjusted as required. For frequencies higher than 10 Hz, the frequency output will be a square wave with a 50% duty cycle.

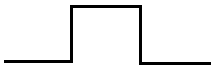
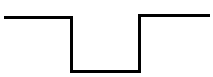
Note: If you are using the Freq = Flow output scale method, and you set maximum pulse width to a value below 277 ms, Micro Motion recommends setting the frequency factor to a value below 200 Hz. See Section 6.6.2.

6.6.4 Configuring the frequency output polarity

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The frequency output *polarity* controls how the output indicates the active (ON) state. See Table 6-12. The default value, Active high, is appropriate for most applications. Active low may be required by applications that use low-frequency signals.

Table 6-12 Polarity settings and frequency output levels

Polarity	Reference voltage (OFF)	Pulse voltage (ON)
Active high 	0	As determined by power supply, pull-up resistor, and load (see the installation manual for your transmitter)
Active low 	As determined by power supply, pull-up resistor, and load (see the installation manual for your transmitter)	0

6.6.5 Configuring mode

• Model 2500 CIO
• Model 2700 CIO

If both Channel B and Channel C are configured as frequency outputs, they function as a dual pulse output. In dual pulse mode, the second frequency output can be phase-shifted either 0°, 180°, +90°, or –90°, or set to Quadrature (the default). See Figure 6-11.

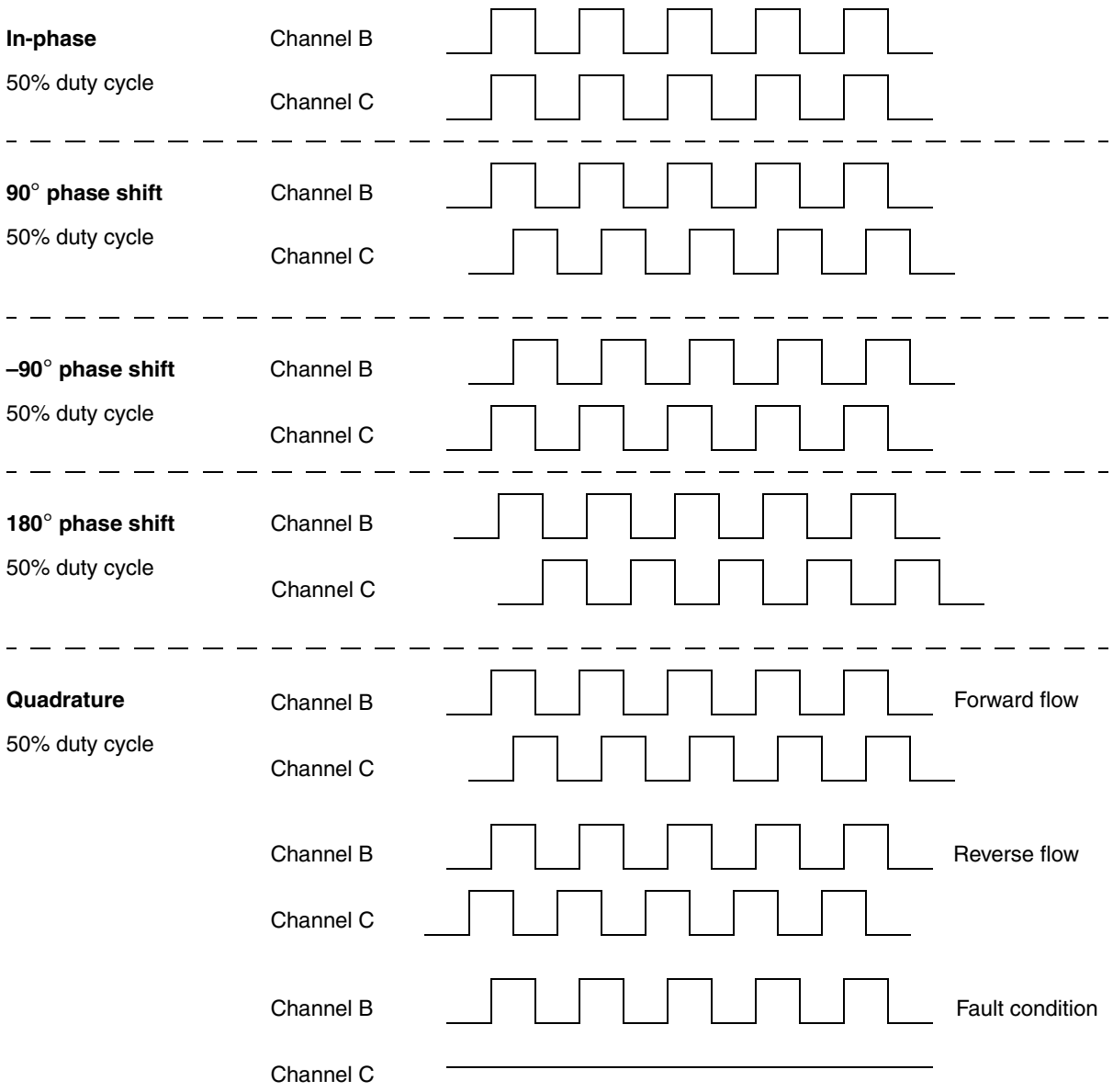
In Quadrature mode, Channel C:

- Lags Channel B by 90° during forward flow.
- Leads Channel C by 90° during reverse flow.
- Is driven to zero during a fault condition.

Quadrature mode is used only for specific Weights & Measures applications where required by law.

Note: If only one channel is configured as a frequency output, **Frequency Output Mode** *is set to* **Single** *and cannot be changed.*

Figure 6-11 Dual pulse output options



6.6.6 Configuring the fault indicator

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If the transmitter encounters an internal fault condition, it will indicate the fault by sending a preprogrammed output level to the receiving device. You can specify the output level by configuring the fault indicator. See Table 6-13.

Note: By default, the transmitter immediately reports a fault when a fault is encountered. You can delay reporting faults by changing the fault timeout. See Section 8.12.

Table 6-13 Frequency output fault indicators and values

Fault indicator	Fault output value
Upscale	The user-specified upscale value between 10 Hz and 15,000 Hz (15,000 Hz default)
Downscale	0 Hz
Internal zero	0 Hz
None	Tracks the data for the assigned process variable; no fault action

⚠ CAUTION

Setting the fault indicator to NONE may result in process error due to undetected fault conditions.

To avoid undetected fault conditions when the fault indicator is set to NONE, use some other mechanism such as digital communication to monitor device status.

6.7 Configuring the discrete output(s)

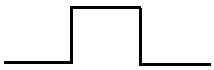
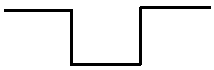
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Different transmitters have different discrete output (DO) options. See Section 6.3, page 47, for information on configuring your transmitter's outputs.

Note: Configure the transmitter for the required input/output types before configuring individual outputs. See Section 6.3.

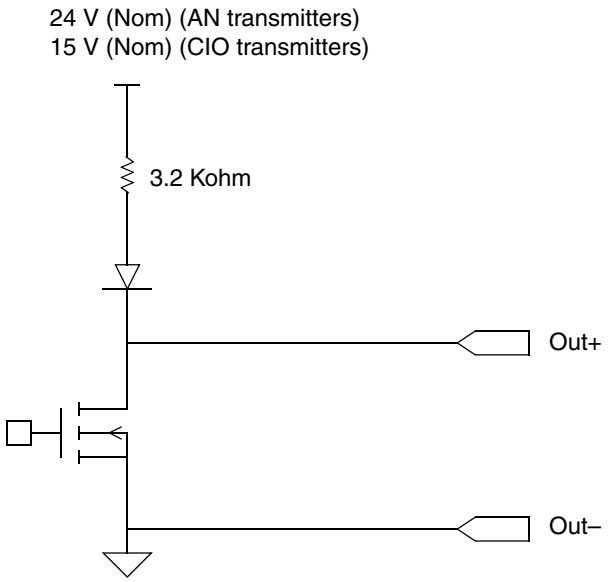
The discrete outputs generate two voltage levels to represent ON or OFF states. The voltage levels depend on the output's polarity, as shown in Table 6-14. Figure 6-12 shows a diagram of a typical discrete output circuit.

Table 6-14 Discrete output polarity

Polarity	Output power	Description
Active high 	Internal	• When asserted (condition tied to DO is true), the circuit provides a pull-up to 24 V (AN transmitters) or 15 V (CIO transmitters). • When not asserted (condition tied to DO is false), the circuit provides 0 V.
	External	• When asserted (condition tied to DO is true), the circuit provides a pull-up to a site-specific voltage, maximum 30 V. • When not asserted (condition tied to DO is false), the circuit provides 0 V.
Active low 	Internal	• When asserted (condition tied to DO is true), the circuit provides 0 V. • When not asserted (condition tied to DO is false), the circuit provides a pull-up to 24 V (AN transmitters) or 15 V (CIO transmitters).
	External	• When asserted (condition tied to DO is true), the circuit provides 0 V. • When not asserted (condition tied to DO is false), the circuit provides a pull-up to a site-specific voltage, to a maximum of 30 V.

(1) On AN transmitters, all outputs are internally powered. On IS transmitters, all outputs are externally powered. On CIO transmitters, the two channels which can be configured as discrete outputs (Channels B and C) can be configured for either internal or external power (see Section 6.3.1).

Figure 6-12 Discrete output circuit



The discrete outputs can be used to indicate the conditions described in Table 6-15. If you have two discrete outputs, you can configure them independently; for example, you can assign one to flow switch and the other to fault.

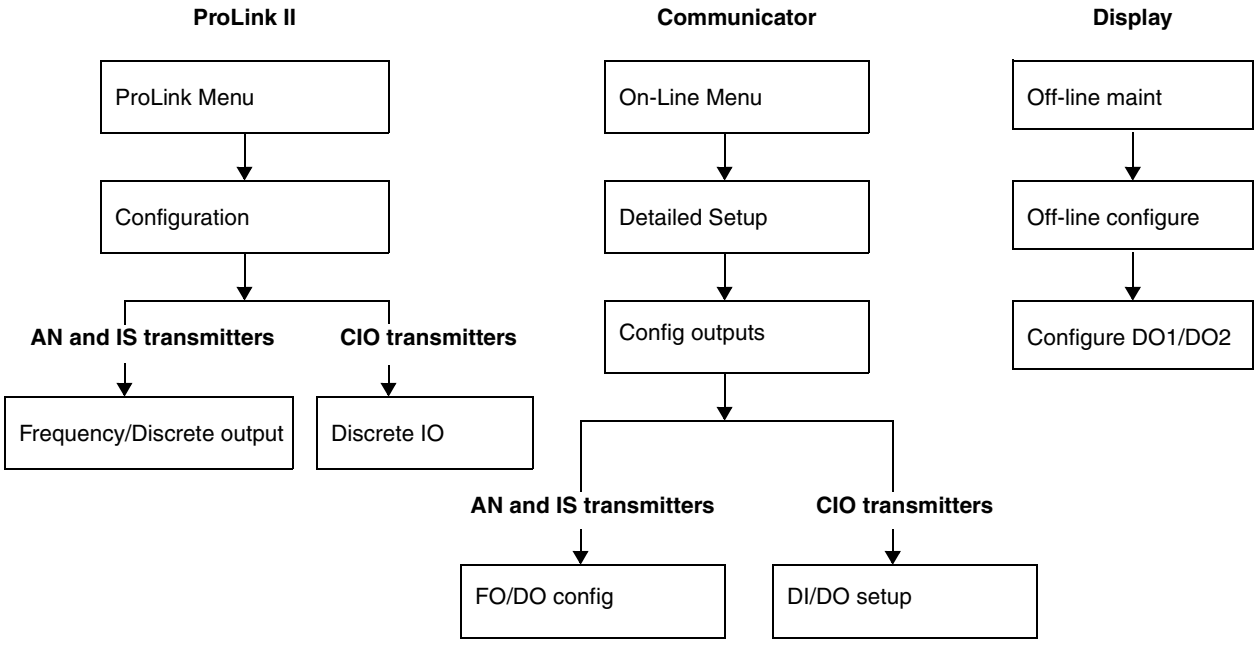
Table 6-15 Discrete output assignments and output levels

Assignment	ProLink II code	Communicator code	Display code	Condition	Discrete output level[1]
Event 1 (see Section 8.10)	Event 1	Event 1	EVNT1	ON	Site-specific
				OFF	0V
Event 2 (see Section 8.10)	Event 2	Event 2	EVNT2	ON	Site-specific
				OFF	0V
Event 1 or Event 2	Event 1 or Event 2	Event1 or Event2	E1OR2	ON	Site-specific
				OFF	0V
Flow switch[2]	Flow Switch	Flow Switch	FLSWT	ON	Site-specific
				OFF	0V
Flow direction	Fwd/Rev	Forward/Reverse	FLDIR	Forward	0V
				Reverse	Site-specific
Calibration in progress	Cal in Progress	Calibration in progr	ZERO	ON	Site-specific
				OFF	0V
Fault	Fault	Fault	FAULT	ON	Site-specific
				OFF	0V

(1) Voltage descriptions in this column assume that Polarity is set to Active high. If Polarity is set to Active low, the voltages are reversed.
(2) See Section 6.7.1.

To configure the discrete output, see the menu flowcharts in Figure 6-13. Note that if you want to configure polarity for the discrete output, you must use ProLink II.

Figure 6-13 Configuring the discrete output(s)



6.7.1 Flow switch

Flow switch refers to the flow rate moving past a user-configured setpoint, in either direction. For example, if the setpoint is 100 lb/min, a flow switch occurs if the flow rate changes from 101 lb/min to 99 lb/min, or from 99 lb/min to 101 lb/min.

The flow switch has a 5% hysteresis. For example, if the setpoint is 100 lb/min, the flow switch will be triggered when the flow rate falls below 100 lb/min, but not turned off until a 5% (5 lb/min) change occurs (i.e., the flow rate rises to 105 lb/min).

If a discrete output is assigned to flow switch, the flow switch setpoint must be configured.

Note: If your transmitter is configured with two discrete outputs, it is possible to configure both DO1 and DO2 for flow switch, but it is not useful because you cannot configure independent setpoints.

6.8 Configuring the discrete input

- Model 2500 CIO
- Model 2700 CIO

The discrete input is used to initiate a transmitter action from a remote input device. If your transmitter has been configured for a discrete input, the actions listed in Table 6-16 may be assigned to the discrete input.

Note: Configure the transmitter for the required input/output types before configuring the discrete input. See Section 6.3.

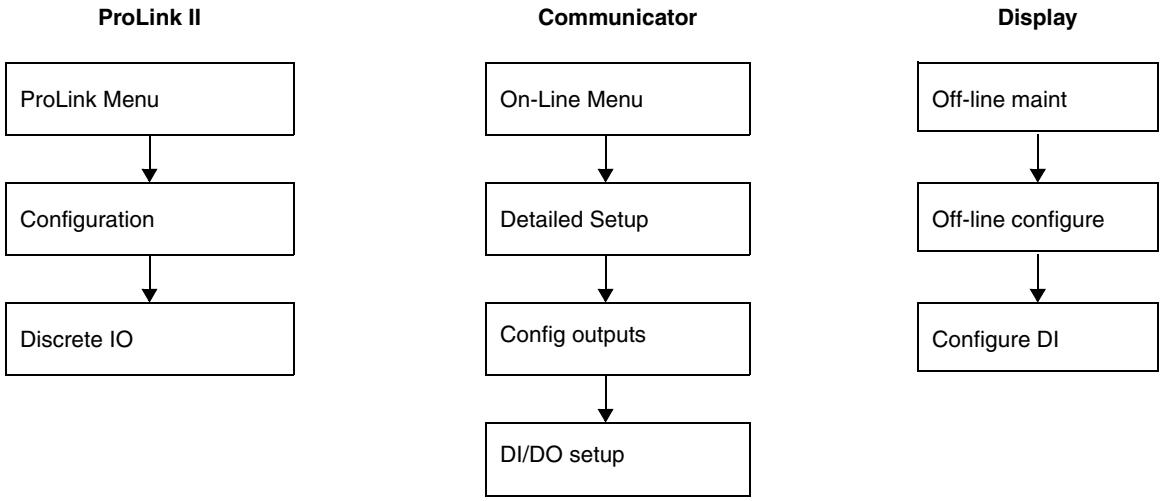
To configure the discrete input, see the menu flowcharts in Figure 6-14.

Table 6-16 Discrete input assignments

Assignment	ProLink II code	Communicator code	Display code
None (default)	None	None	NONE
Flowmeter zero	Start Mechanical Zero	Perform auto zero	ZERO
Reset mass totalizer	Reset Mass Total	Reset mass total	MASS
Reset volume totalizer	Reset Volume Total	Reset volume total	VOL
Reset temperature-corrected volume totalizer(1)	Reset Corrected Volume Total	Reset corrected volume total	TCVOL
Reset all totalizers	Reset Totals	Reset totals	ALL

(1) Available only if the API feature has been enabled on your transmitter.

Figure 6-14 Configuring the discrete input



Chapter 7
Using the Transmitter

7.1 Overview

This chapter describes how to use the transmitter in everyday operation. The following topics and procedures are discussed:

- Special applications on your transmitter (see Section 7.2)
- Viewing process variables and API process variables (see Sections 7.4 and 7.5)
- Viewing transmitter status and alarms (see Section 7.6)
- Acknowledging alarms (see Section 7.7)
- Viewing and using the totalizers and inventories (see Section 7.8)

Note: All ProLink II procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Chapter 3 for more information.

Note: If you are using AMS, the AMS interface will be similar to the ProLink II interface described in this chapter.

Note: All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

7.2 Special applications

Your transmitter may support one of the following special applications:

- Petroleum measurement (API feature)
- Enhanced density
- Custody transfer

The special application must be enabled at the factory or by a Micro Motion field service engineer.

Configuration of the petroleum measurement application is discussed in Section 8.5. Configuration of the enhanced density application is discussed in Appendix D. For information on setting up custody transfer, contact Micro Motion.

7.3 Recording process variables

Micro Motion suggests that you make a record of the process variables listed below, under normal operating conditions. This will help you recognize when the process variables are unusually high or low, and may help in fine-tuning transmitter configuration.

Record the following process variables:

- Flow rate
- Density
- Temperature
- Tube frequency
- Pickoff voltage
- Drive gain

For information on using this information in troubleshooting, see Section 10.12.

7.4 Viewing process variables

Process variables include measurements such as mass flow rate, volume flow rate, mass total, volume total, temperature, and density.

You can view process variables with the display (Model 1700 and 2700 transmitters only), ProLink II, or the Communicator.

7.4.1 With the display

The display reports the abbreviated name of the process variable (e.g., **DENS** for density), the current value of that process variable, and the associated unit of measure (e.g., G/CM3). See Appendix J for information on the codes and abbreviations used for display variables.

The display must be configured. For instructions on how to configure the display, see Section 8.14.1.

To view a process variable with the display, press **Scroll** until the name of the desired process variable either:

- Appears on the process variable line, or
- Begins to alternate with the units of measure

See Figure 2-1.

7.4.2 With ProLink II

To view process variables with ProLink II software:

1. The **Process Variables** window opens automatically when you first connect to the transmitter.
2. If you have closed the **Process Variables** window:
   a. Open the **Prolink** menu.
   b. Select **Process Variables**.

7.4.3 With a Communicator

To view process variables with a Communicator:

1. Press **1**, **1**.
2. Scroll through the list of process variables by pressing **Down Arrow**.
3. Press the number corresponding to the process variable you wish to view, or highlight the process variable in the list and press **Right Arrow**.

7.5 Viewing API process variables

API process variables include measurements such as batch-weighted average observed density and CTL (Correction of Temperature on volume of Liquids). You can view API process variables with the display (Model 1700 and 2700 transmitters with displays only), ProLink II software, or the Communicator.

Note: API process variables are available only if the petroleum measurement application (API feature) is enabled on your transmitter.

7.5.1 With the display

The display reports the abbreviated name of the process variable (e.g., **DENS** for density, or **TCORR** for temperature-corrected density), the current value of that process variable, and the associated unit of measure.

The display must be configured. For instructions on configuring the display, see Section 8.14.1.

To view an API process variable with the display, press **Scroll** until the name of the desired API process variable either:

- Appears on the process variable line, or
- Begins to alternate with the units of measure

See Figure 2-1.

7.5.2 With ProLink II

To view API process variables with ProLink II software:

1. Click **ProLink**.
2. Select **API Process Variables** from the menu.

7.5.3 With a Communicator

To view API process variables with a Communicator:

1. Press **1**, **1**.
2. Scroll through the list of process variables by pressing **Down Arrow**.
3. Select the desired API process variable in the list and press **Right Arrow**.

7.6 Viewing transmitter status and alarms

You can view transmitter status using the status LED or display, ProLink II, or the Communicator.

The transmitter broadcasts alarms whenever a process variable exceeds its defined limits or the transmitter detects a fault condition. You can view alarms with the display, ProLink II, or the Communicator. For information regarding all the possible alarms, see Table 10-5.

To acknowledge alarms, you must use the display. Acknowledging alarms is required only for transmitters that have a display.

7.6.1 Using the status LED

- Model 1500 AN
- Model 2500 CIO

For these transmitters, the status LED is located on the front panel. This LED shows transmitter status as described in Table 7-1.

Table 7-1 Transmitter status reported by the Model 1500/2500 status LED

Status LED state	Alarm priority	Definition
Green	No alarm	Normal operating mode
Flashing yellow	No alarm	Zero in progress
Yellow	Low severity alarm	• Alarm condition: will not cause measurement error • Outputs continue to report process data
Red	High severity (critical fault) alarm	• Alarm condition: will cause measurement error • Outputs go to configured fault indicators

7.6.2 Using the display

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The display reports alarms in two ways:

- With the status LED, which reports only that one or more alarms has occurred
- Through the alarm queue, which reports each specific alarm

Note: If access to the alarm menu from the display has been disabled (see Section 8.14.1), then the display will not list alarm codes in an alarm queue, and the status LED will not flash. It will indicate status using solid green, yellow, or red.

For these transmitters, the status LED is located at the top of the display (see Figure 7-1). It can be in one of six possible states, as listed in Table 7-1.

Figure 7-1 Display status LED

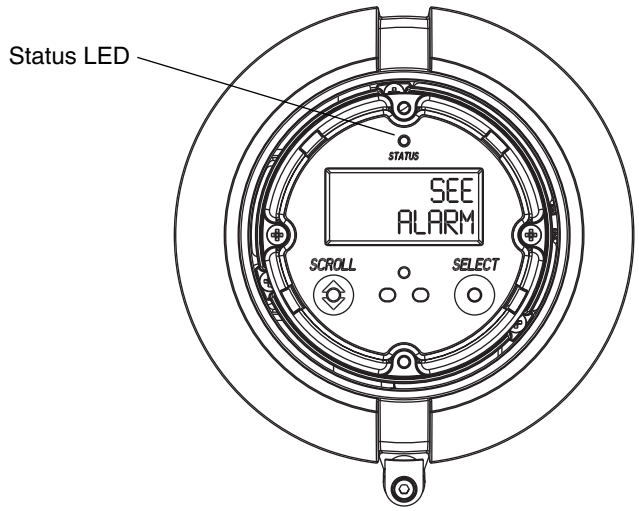


Table 7-2 Priorities reported by the Model 1700/2700 status LED

Status LED state	Alarm priority
Green	No alarm—normal operating mode
Flashing green(1)	Unacknowledged corrected condition
Yellow	Acknowledged low severity alarm
Flashing yellow(1)	Unacknowledged low severity alarm
Red	Acknowledged high severity alarm
Flashing red(1)	Unacknowledged high severity alarm

(1) If the display alarm menu has been disabled, alarms cannot be acknowledged. In this case, the status LED will never flash.

Alarms in the alarm queue are arranged according to priority. To view specific alarms in the queue:

1. Activate and hold **Scroll** and **Select** simultaneously until the words **SEE ALARM** appear on the screen. See Figure 7-1.
2. **Select**.
3. If the alternating words **ACK ALL** appear, **Scroll**.
4. If the words **NO ALARM** appear, go to Step 6.
5. **Scroll** to view each alarm in the queue. See Section 10.11 for an explanation of the alarm codes reported by the display.
6. **Scroll** until the word **EXIT** appears.
7. **Select**.

7.6.3 Using ProLink II

To view status and alarms with ProLink II software:

1. Click **ProLink**.
2. Select **Status**.
3. The status indicators are divided into three categories: Critical, Informational, and Operational. To view the indicators in a category, click on the tab.
   - A tab is red if one or more status indicators in that category is on.
   - Within the tabs, current status alarms are shown by red status indicators.

7.6.4 Using the Communicator

To view status and alarms with a Communicator:

1. Press **1**.
2. Select **View Status**.
3. Press **OK** to scroll through the list of current alarms.

7.7 Acknowledging alarms

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Acknowledging alarms is a display function. It is required only for transmitters that have a display, and when access to the alarm menu from the display is enabled.

For transmitters with a display, access to the alarm menu can be enabled or disabled. If access to the alarm menu is enabled, the operator may or may not be allowed to acknowledge all alarms simultaneously (the **Ack All?** function). See Section 8.14.1 for information on controlling these functions.

If access to the alarm menu is disabled, the status LED will always be solid red, green, or yellow.

To acknowledge alarms:

1. Activate and hold **Scroll** and **Select** simultaneously until the words **SEE ALARM** appear on the screen. See Figure 7-1.
2. **Select**.
3. If the words **NO ALARM** appear, go to Step 8.
4. If you want to acknowledge all alarms:
   a. **Scroll** until the word **ACK** appears by itself. The word **ACK** begins to alternate with the word **ALL?**.
   b. **Select**.

Note: If the "acknowledge all alarms" feature has been disabled (see Section 8.14.1, then you must acknowledge each alarm individually. See Step 5.

5. If you want to acknowledge a single alarm:
   a. **Scroll** until the alarm you want to acknowledge appears.
   b. **Select**. The word **ALARM** begins to alternate with the word **ACK**.
   c. **Select** to acknowledge the alarm.
6. If you want to acknowledge another alarm, go to Step 3.
7. If you do NOT want to acknowledge any more alarms, go to Step 8.
8. **Scroll** until the word **EXIT** appears.
9. **Select**.

7.8 Using the totalizers and inventories

The *totalizers* keep track of the total amount of mass or volume measured by the transmitter over a period of time. The totalizers can be viewed, started, stopped, and reset.

The *inventories* track the same values as the totalizers but can be reset separately. Because the inventories are reset separately, you can keep a running total of mass or volume across multiple totalizer resets.

7.8.1 Viewing the totalizers and inventories

You can view the current value of the totalizers and inventories with the display (Model 1700 and 2700 transmitters with displays only), ProLink II, or the Communicator.

With the display

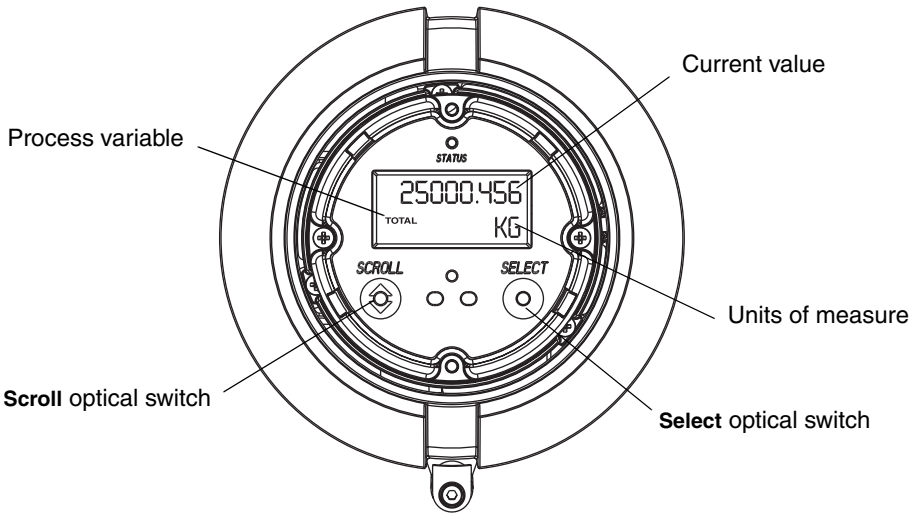
You cannot view totalizers or inventories with the display unless the display has been configured to show them. See Sections 8.14.1 and 8.14.4.

1. To view totalizer values, **Scroll** until the process variable **TOTAL** appears and the units of measure are:
   - For the mass totalizer, mass units (e.g., kg, lb)
   - For the volume totalizer, volume units (e.g., gal, cuft)

   See Figure 7-2. Read the current value from the top line of the display.
2. To view inventory values, **Scroll** until the process variable **TOTAL** appears and:
   - For the mass inventory, the word **MASSI** (Mass Inventory) begins to alternate with the units of measure
   - For the volume inventory, the word **LVOLI** (Line Volume Inventory) begins to alternate with the units of measure

   See Figure 7-2. Read the current value from the top line of the display.

Figure 7-2 Display totalizer



With ProLink II software

To view the current value of the totalizers and inventories with ProLink II software:

1. Click **ProLink**.
2. Select **Process Variables** or **Totalizer Control**.

With a Communicator

To view the current value of the totalizers and inventories with a Communicator:

1. Press **1**, **1**.
2. Select **Mass totl**, **Mass inventory**, **Vol totl**, or **Vol inventory**.

7.8.2 Viewing the API totalizers and inventories

To view the current values of the API totalizers and inventories, use the procedures described in Section 7.5.

7.8.3 Controlling totalizers and inventories

Table 7-3 shows all of the totalizer and inventory functions and which configuration tools you can use to control them.

Table 7-3 Totalizer and inventory control methods

Function name	Communicator	ProLink II software	Display(1)
Stop all totalizers and inventories (mass, volume, and API)	Yes	Yes	Yes(2)
Start all totalizers and inventories (mass, volume, and API)	Yes	Yes	Yes(2)
Reset mass totalizer only	Yes	Yes	Yes(2)
Reset volume totalizer only	Yes	Yes	Yes(2)
Reset API totalizer only	No	No	Yes(2)
Simultaneously reset all totalizers (mass, volume, and API)	Yes	Yes	Yes(2)
Simultaneously reset all inventories (mass, volume, and API)	No	Yes(3)	No

(1) Model 1700 and 2700 transmitters with display only.
(2) If enabled. See Section 8.14.1.
(3) If enabled in the ProLink II preferences.

With the display

Table 7-4 shows how you can control the totalizers and inventories with the display.

Table 7-4 Totalizer and inventory control with the display

To accomplish this	Press this sequence of buttons
Stop all totalizers and inventories (mass, volume, and API)(1)	• **Scroll** until a totalizer value appears (the word **TOTAL** appears in the lower left corner of the display). It does not matter whether the total is mass, volume, or API. • **Select.** • If a password is required (**CODE?** appears), enter it and **Select.**(2) • **Scroll** until **STOP** appears beneath the current totalizer value. • **Select** (**YES** alternates with **STOP**). • **Select** (all totalizers and inventories stop).
Start all totalizers and inventories (mass, volume, and API)(1)	• **Scroll** until a totalizer value appears (the word **TOTAL** appears in the lower left corner of the display). It does not matter whether the total is mass, volume, or API. • **Select.** • If a password is required (**CODE?** appears), enter it and **Select.**(2) • **Scroll** until **START** appears beneath the current totalizer value. • **Select** (**YES** alternates with **START**). • **Select** (all totalizers and inventories start).

Table 7-4 Totalizer and inventory control with the display (continued)

To accomplish this	Press this sequence of buttons
Reset mass totalizer[1]	• **Scroll** until the mass totalizer value appears. • **Select.** • If a password is required (**CODE?** appears), enter it and **Select.**[2] • **Scroll** until **RESET** appears beneath the current totalizer value. • **Select** (**YES** alternates with **RESET**). • **Select** (mass totalizer resets).
Reset volume totalizer[1]	• **Scroll** until the volume totalizer value appears. • **Select.** • If a password is required (**CODE?** appears), enter it and **Select.**[2] • **Scroll** until **RESET** appears beneath the current totalizer value. • **Select** (**YES** alternates with **RESET**). • **Select** (volume totalizer resets).
Reset API totalizer[1]	• **Scroll** until an API totalizer value appears. • **Select.** • A password is always required (**CODE?** appears). Enter it and Select.[2] • **Scroll** until **RESET** appears beneath the current totalizer value. • **Select** (**YES** alternates with **RESET**). • **Select** (API totalizer resets).

(1) With rev3.3 or higher of the transmitter software, this feature may be enabled or disabled. See Section 8.14.1.

(2) A password is required only if the petroleum measurement application (API feature) is enabled. If the petroleum measurement application is not enabled, no password is required even if the display password has been enabled.

With ProLink II software

Table 7-5 shows how you can control the totalizers and inventories using ProLink II software.

Table 7-5 Totalizer and inventory control with ProLink II software

To accomplish this	On the totalizer control screen...
Stop all totalizers and inventories (mass, volume, and API)	Click **Stop**
Start all totalizers and inventories (mass, volume, and API)	Click **Start**
Reset mass totalizer	Click **Reset Mass Total**
Reset volume totalizer	Click **Reset Volume Total**
Simultaneously reset all totalizers (mass, volume, and API)	Click **Reset**
Simultaneously reset all inventories (mass, volume, and API)[1]	Click **Reset Inventories**

(1) If enabled in the ProLink II preferences.

To get to the Totalizer Control screen:

1. Click **ProLink**.
2. Select **Totalizer Control**.

With a Communicator

Table 7-6 shows how you can control the totalizers and inventories with a Communicator.

Table 7-6 Totalizer and inventory control with a Communicator

To accomplish this	Press this sequence of buttons
Stop all totalizers and inventories (mass, volume, and API)	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Stop totalizer**
Start all totalizers and inventories (mass, volume, and API)	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Start totalizer**
Reset mass totalizer	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Reset mass total**
Reset volume totalizer	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Reset volume total**
Reset all totalizers (mass, volume, and API)	• **1** (Process Variables) • **4** (Totalizer cntrl) • **Reset all totals**

Chapter 8
Optional Configuration

8.1 Overview

This chapter describes transmitter configuration parameters that may or may not be used, depending on your application requirements. For required transmitter configuration, see Chapter 6.

8.2 Configuration map

Different transmitters support different parameters and features. Additionally, different configuration tools allow you to configure different features. Table 8-1 lists the optional configuration parameters. For each parameter, the table also lists the transmitters that support that parameter and a reference to the section where the parameter is discussed.

The configuration map uses the following codes:

- **AN** – transmitters with the analog outputs option board
- **IS** – transmitters with the intrinsically safe outputs option board
- **CIO** – transmitters with the configurable input/outputs option board

Default values and ranges for the most commonly used parameters are provided in Appendix A.

8.3 How to access a parameter for configuration

In general, all parameters discussed in this chapter can be configured either with ProLink II or the Communicator, but cannot be configured with the display. Exceptions are noted in the configuration map.

For information on the menu structure for each transmitter, and how to access a particular parameter, see the appendix for your transmitter, as listed below. Within that appendix, refer to the menu flowcharts for the communication tool you are using: ProLink II, the Communicator, or the display.

- Model 1500 AN – see Appendix E
- Model 2500 CIO – see Appendix F
- Model 1700/2700 AN – see Appendix G
- Model 1700/2700 IS – see Appendix H
- Model 2700 CIO – see Appendix I

Note: If you are using AMS, the AMS interface will be similar to the ProLink II interface.

Table 8-1 Configuration map

		Transmitter							
		1500	1700		2500	2700			
Topic	**Subtopic**	**AN**	**AN**	**IS**	**CIO**	**AN**	**IS**	**CIO**	**Section**
Special measurement units	Mass flow	✓	✓	✓		✓	✓	✓	8.4
	Volume flow	✓	✓	✓		✓	✓	✓	8.4.3
Petroleum measurement application (API feature)					✓	✓	✓	✓	8.5
Cutoffs		✓	✓	✓	✓	✓	✓	✓	8.6
Damping		✓	✓	✓	✓	✓	✓	✓	8.7
Update rate		✓	✓	✓	✓	✓	✓	✓	8.8
Flow direction		✓	✓	✓	✓	✓	✓	✓	8.9
Events		✓	✓	✓	✓	✓	✓	✓	8.10
Slug flow		✓	✓	✓	✓	✓	✓	✓	8.11
Fault timeout		✓	✓	✓	✓	✓	✓	✓	8.12
Meter factors		✓	✓	✓	✓	✓	✓	✓	8.13
Display functionality(1)	Enable and disable functions		✓(1)	✓(1)		✓(1)	✓(1)	✓(1)	8.14.1
	Scroll rate		✓	✓		✓	✓	✓	8.14.2
	Password		✓	✓		✓	✓	✓	8.14.3
	Display variables		✓	✓		✓	✓	✓	8.14.4
Digital communication settings	Fault indicator	✓	✓	✓	✓	✓	✓	✓	8.15.1
	HART polling address	✓	✓(1)	✓(1)	✓	✓(1)	✓(1)	✓(1)	8.15.2
	Modbus address	✓(2)	✓(2)		✓(2)	✓(2)			8.15.3
	RS-485 settings	✓	✓(1)		✓	✓(1)			8.15.4
	HART burst mode	✓	✓	✓	✓	✓	✓	✓	8.15.5
	PV, SV, TV, QV assignments	✓	✓	✓	✓	✓	✓	✓	8.15.6
Device settings		✓	✓	✓	✓	✓	✓	✓	8.16
Sensor parameters		✓	✓	✓	✓	✓	✓	✓	8.17

(1) Can be configured with ProLink II, the Communicator, or the display.
(2) Can be configured with ProLink II or the display; cannot be configured with the Communicator.

8.4 Creating special measurement units

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If you need to use a non-standard unit of measure, you can create one special measurement unit for mass flow and one special measurement unit for volume flow.

8.4.1 About special measurement units

Special measurement units consist of:

- Base unit — A combination of:
  - Base mass or base volume unit — A measurement unit that the transmitter already recognizes (e.g., kg, m3)
  - Base time unit — A unit of time that the transmitter already recognizes (e.g., seconds, days)
- Conversion factor — The number by which the base unit will be divided to convert to the special unit
- Special unit — A non-standard volume flow or mass flow unit of measure that you want to be reported by the transmitter

The terms above are related by the following formula:

$$x[\text{BaseUnit(s)}] = y[\text{SpecialUnit(s)}]$$

$$\text{ConversionFactor} = \frac{x[\text{BaseUnit(s)}]}{y[\text{SpecialUnit(s)}]}$$

To create a special unit, you must:

1. Identify the simplest base volume or mass and base time units for your special mass flow or volume flow unit. For example, to create the special volume flow unit *pints per minute*, the simplest base units are gallons per minute:
   - Base volume unit: *gallon*
   - Base time unit: *minute*
2. Calculate the conversion factor using the formula below:

$$\frac{1 \text{ (gallon per minute)}}{8 \text{ (pints per minute)}} = \mathbf{0.125} \text{ (conversion factor)}$$

Note: 1 gallon per minute = 8 pints per minute

3. Name the new special mass flow or volume flow measurement unit and its corresponding totalizer measurement unit:
   - Special volume flow measurement unit name: *Pint/min*
   - Volume totalizer measurement unit name: *Pints*

Note: Special measurement unit names can be up to 8 characters long (i.e., 8 numbers or letters), but only the first 5 characters appear on the display.

4. To apply the special measurement unit to mass flow or volume flow measurement, select **Special** from the list of measurement units (see Section 6.4.1 or 6.4.2).

8.4.2 Special mass flow unit

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

To create a special mass flow measurement unit:

1. Specify the base mass unit.
2. Specify the base time unit.
3. Specify the mass flow conversion factor.
4. Assign a name to the new special mass flow measurement unit.
5. Assign a name to the mass totalizer measurement unit.

Note: You cannot create a special mass flow measurement unit with the display, but you can view the special mass flow measurement on the display.

8.4.3 Special volume flow unit

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

To create a special volume flow measurement unit:

1. Specify the base volume unit.
2. Specify the base time unit.
3. Specify the volume flow conversion factor.
4. Assign a name to the new special volume flow measurement unit.
5. Assign a name to the volume totalizer measurement unit.

Note: You cannot create a special volume flow measurement unit with the display, but you can view the special volume flow measurement on the display.

8.4.4 Special unit for gas

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

For many gas applications, standard or normal volume flow rate is used as the quasi mass flow rate. Standard or normal volume flow rate is calculated as the mass flow rate divided by the density of the gas at a reference condition.

To configure a mass flow special unit that represents standard or normal volume flow rate, you must calculate the mass flow conversion factor from the density of the gas at a reference temperature, pressure, and composition.

ProLink II offers a Gas Unit Configurator tool to calculate this mass flow conversion factor. The tool will automatically update the mass flow conversion factor in the **Special Units** tab. If ProLink II is not available, special mass units can be used to set up standard or normal volume flow units for gas applications.

Note: Micro Motion recommends that you do not use the flowmeter to measure actual volume flow of a gas (volumetric flow at line conditions). If you need to measure actual volume flow, contact Micro Motion customer support.

⚠ CAUTION

The flowmeter should not be used for measuring the actual volume of gases.

Standard or normal volume is the traditional unit for gas flow. Coriolis flowmeters measure mass. Mass divided by standard or normal density yields standard or normal volume units.

To use the Gas Unit Configurator:

1. Start ProLink II and connect to your transmitter.
2. Open the **Configuration** window.
3. Click the **Special Units** tab.
4. Click the **Gas Unit Configurator** button.
5. Select the **Time Unit** that your special unit will be based on.
6. Click a radio button to specify that your special unit will be defined in terms of **English Units** or **SI** (*Système International*) **Units**.
7. Click **Next**.
8. Define the standard density to be used in calculations.
   - To use a fixed standard density, click the top radio button, enter a value for standard density in the **Standard Density** textbox, and click **Next**.
   - To use a calculated standard density, click the second radio button and click **Next**. Then enter values for **Reference Temperature**, **Reference Pressure**, and **Specific Gravity** on the next panel, and click **Next**.
9. Check the values displayed.
   - If they are appropriate for your application, click **Finish**. The special unit data will be written to the transmitter.
   - If they are not appropriate for your application, click **Back** as many times as necessary to return to the relevant panel, correct the problem, then repeat the above steps.

8.5 Configuring the petroleum measurement application (API feature)

- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The *API parameters* determine the values that will be used in API-related calculations. The API parameters are available only if the petroleum measurement application is enabled on your transmitter.

8.5.1 About the petroleum measurement application

The petroleum measurement enables *Correction of Temperature on volume of Liquids*, or CTL. In other words, some applications that measure liquid volume flow or liquid density are particularly sensitive to temperature factors, and must comply with American Petroleum Institute (API) standards for measurement.

Terms and definitions

The following terms and definitions are relevant to the petroleum measurement application:

- *API* – American Petroleum Institute
- *CTL* – Correction of Temperature on volume of Liquids. The CTL value is used to calculate the VCF value
- *TEC* – Thermal Expansion Coefficient
- *VCF* – Volume Correction Factor. The correction factor to be applied to volume process variables. VCF can be calculated after CTL is derived

CTL derivation methods

There are two derivation methods for CTL:

- Method 1 is based on observed density and observed temperature.
- Method 2 is based on a user-supplied reference density (or thermal expansion coefficient, in some cases) and observed temperature.

API parameters

The API parameters are listed and defined in Table 8-2.

Table 8-2 API parameters

Variable	Description
Table type	Specifies the table that will be used for reference temperature and reference density unit. Select the table that matches your requirements. See *API reference tables*.
User defined TEC(1)	Thermal expansion coefficient. Enter the value to be used in CTL calculation.
Temperature units(2)	Read-only. Displays the unit used for reference temperature in the reference table.
Density units	Read-only. Displays the unit used for reference density in the reference table.
Reference temperature	Read-only unless Table type is set to 53*x* or 54*x*. If configurable: • Specify the reference temperature to be used in CTL calculation. • Enter reference temperature in °C.

(1) Configurable if Table type is set to 6C, 24C, or 54C.

(2) In most cases, the temperature unit used by the API reference table should also be the temperature unit configured for the transmitter to use in general processing. To configure the temperature unit, see Section 6.4.4.

API reference tables

Reference tables are organized by reference temperature, CTL derivation method, liquid type, and density unit. The table selected here controls all the remaining options.

- Reference temperature:
  - If you specify a 5*x*, 6*x*, 23*x*, or 24*x* table, the default reference temperature is 60 °F, and cannot be changed.
  - If you specify a 53*x* or 54*x* table, the default reference temperature is 15 °C. However, you can change the reference temperature, as recommended in some locations (for example, to 14.0 or 14.5 °C).
- CTL derivation method:
  - If you specify an odd-numbered table (5, 23, or 53), CTL will be derived using method 1 described above.
  - If you specify an even-numbered table (6, 24, or 54), CTL will be derived using method 2 described above.

- The letters *A*, *B*, *C*, or *D* that are used to terminate table names define the type of liquid that the table is designed for:
  - *A* tables are used with generalized crude and JP4 applications.
  - *B* tables are used with generalized products.
  - *C* tables are used with liquids with a constant base density or known thermal expansion coefficient.
  - *D* tables are used with lubricating oils.
- Different tables use different density units:
  - Degrees API
  - Relative density (SG)
  - Base density (kg/m^3)

Table 8-3 summarizes these options.

Table 8-3 API reference temperature tables

Table	CTL derivation method	Base temperature	Density unit and range		
			Degrees API	**Base density**	**Relative density**
5A	Method 1	60 °F, non-configurable	0 to 100		
5B	Method 1	60 °F, non-configurable	0 to 85		
5D	Method 1	60 °F, non-configurable	–10 to +40		
23A	Method 1	60 °F, non-configurable			0.6110 to 1.0760
23B	Method 1	60 °F, non-configurable			0.6535 to 1.0760
23D	Method 1	60 °F, non-configurable			0.8520 to 1.1640
53A	Method 1	15 °C, configurable		610 to 1075 kg/m^3	
53B	Method 1	15 °C, configurable		653 to 1075 kg/m^3	
53D	Method 1	15 °C, configurable		825 to 1164 kg/m^3	
			Reference temperature		**Supports**
6C	Method 2	60 °F, non-configurable	60 °F		Degrees API
24C	Method 2	60 °F, non-configurable	60 °F		Relative density
54C	Method 2	15 °C, configurable	15 °C		Base density in kg/m^3

Temperature data

For the temperature value to be used in CTL calculation, you can use the temperature data from the sensor, or you can poll an external temperature device:

- To use temperature data from the sensor, no action is required.
- To poll an external temperature device, configure polling for temperature as described in Section 9.4. When polling is enabled, the transmitter will automatically use the external temperature value for CTL calculation.

8.6 Configuring cutoffs

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Cutoffs are user-defined values below which the transmitter reports a value of zero for the specified process variable. Cutoffs can be set for mass flow, volume flow, or density.

Note: The density cutoff is available only with core processor software 2.0 or above and MVD software rev 3.0 or above.

See Table 8-4 for cutoff default values and related information. See Sections 8.6.1 and 8.6.2 for information on how the cutoffs interact with other transmitter measurements.

Table 8-4 Cutoff default values

Cutoff type	Default	Comments
Mass flow	0.0 g/s	Recommended setting: 0.5–1.0% of the sensor's rated maximum flowrate
Volume flow	0.0 L/s	Lower limit: 0 Upper limit: the sensor's flow calibration factor, in units of L/s, multiplied by 0.2
Density	0.2 g/cm^3	Range: 0.0–0.5 g/cm^3

8.6.1 Cutoffs and volume flow

The mass flow cutoff is not applied to the volume flow calculation. Even if the mass flow drops below the cutoff, and therefore the mass flow indicators go to zero, the volume flow rate will be calculated from the actual mass flow process variable.

However, the density cutoff is applied to the volume flow calculation. Accordingly, if the density drops below its configured cutoff value, the volume flow rate will go to zero.

8.6.2 Interaction with the AO cutoffs

Both the primary mA output and the secondary mA output (if it is available on your transmitter) have cutoffs (the AO cutoffs). If the mA outputs are configured for mass and volume flow:

- And the AO cutoffs are set to a greater value than the mass and volume cutoffs, the flow indicators will go to zero when the AO cutoff is reached.
- And the AO cutoffs are set to a lower value than the mass or volume cutoff, the flow indicator will go to zero when the mass or volume cutoff is reached.

See Section 6.5.3 for more information on the AO cutoff(s).

8.7 Configuring the damping values

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

A damping value is a period of time, in seconds, over which the process variable value will change to reflect 63% of the change in the actual process. Damping helps the transmitter smooth out small, rapid measurement fluctuations.

- A high damping value makes the output appear to be smoother because the output must change slowly.
- A low damping value makes the output appear to be more erratic because the output changes more quickly.

When you specify a new damping value, it is automatically rounded down to the nearest valid damping value. Flow, density, and temperature have different valid damping values. Valid damping values are listed in Table 8-5.

Note: For gas applications, Micro Motion recommends a flow damping value of 3.2.

Before setting the damping values, review Sections 8.7.1 through 8.7.3 for information on how the damping values interact with other transmitter measurements and parameters.

Table 8-5 Valid damping values

Process variable	Update rate(1)	Valid damping values
Flow (mass and volume)	Normal (20 Hz)	0, .2, .4, .8, ... 51.2
	Special (100 Hz)	0, .04, .08, .16, ... 10.24
Density	Normal (20 Hz)	0, .2, .4, .8, ... 51.2
	Special (100 Hz)	0, .04, .08, .16, ... 10.24
Temperature	Not applicable	0, .6, 1.2, 2.4, 4.8, ... 76.8

(1) See Section 8.7.3.

8.7.1 Damping and volume measurement

When configuring damping values, be aware that volume measurement is derived from mass and density measurements; therefore, any damping applied to mass flow and density will affect volume measurements. Be sure to set damping values accordingly.

8.7.2 Interaction with the added damping parameter

Both the primary mA output and the secondary mA output (if it is available on your transmitter) have a damping parameter (added damping). If damping is configured for flow, density, or temperature, the same process variable is assigned to an mA output, and added damping is also configured for the mA output, the effect of damping the process variable is calculated first, and the added damping calculation is applied to the result of that calculation.

See Section 6.5.5 for more information on the added damping parameter.

8.7.3 Interaction with the update rate

Flow and density damping values depend on the configured update rate (see Section 8.8). If you change the update rate, the damping values are automatically adjusted.

Note: The specific process variable selected for the 100 Hz update rate is not relevant; all damping values are adjusted as described.

8.8 Configuring the update rate

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The update rate is the rate at which the sensor reports the process variables to the transmitter. This affects transmitter response time to changes in the process.

There are two settings for the update rate: **Normal** and **Special**.

- When **Normal** is configured, all process variables are reported at the rate of 20 times per second (20 Hz).
- When **Special** is configured, a single, user-specified process variable is updated at 100 times per second (100 Hz), and all other process variables are updated at 6.25 times per second (6.25 Hz). If you set the update rate to **Special**, you must also specify which process variable will be updated at 100 Hz.

Note: Most users should select the Normal *update rate. Use the* Special *update rate only if required by your application. Contact Micro Motion before setting the update rate to* Special.

Note: If you change the update rate, the setting for damping is automatically adjusted. See Section 8.7.3.

8.9 Configuring the flow direction parameter

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The *flow direction* parameter controls how the transmitter reports flow rate and how flow is added to or subtracted from the totalizers, under conditions of forward flow, reverse flow, or zero flow.

- *Forward (positive) flow* moves in the direction of the arrow on the sensor.
- *Reverse (negative) flow* moves in the direction opposite of the arrow on the sensor.

Options for flow direction include:

- Forward only
- Reverse only
- Absolute value
- Bidirectional
- Negate/Forward only (Model 1500/2500 transmitters only)
- Negate/Absolute value (Model 1500/2500 transmitters only)

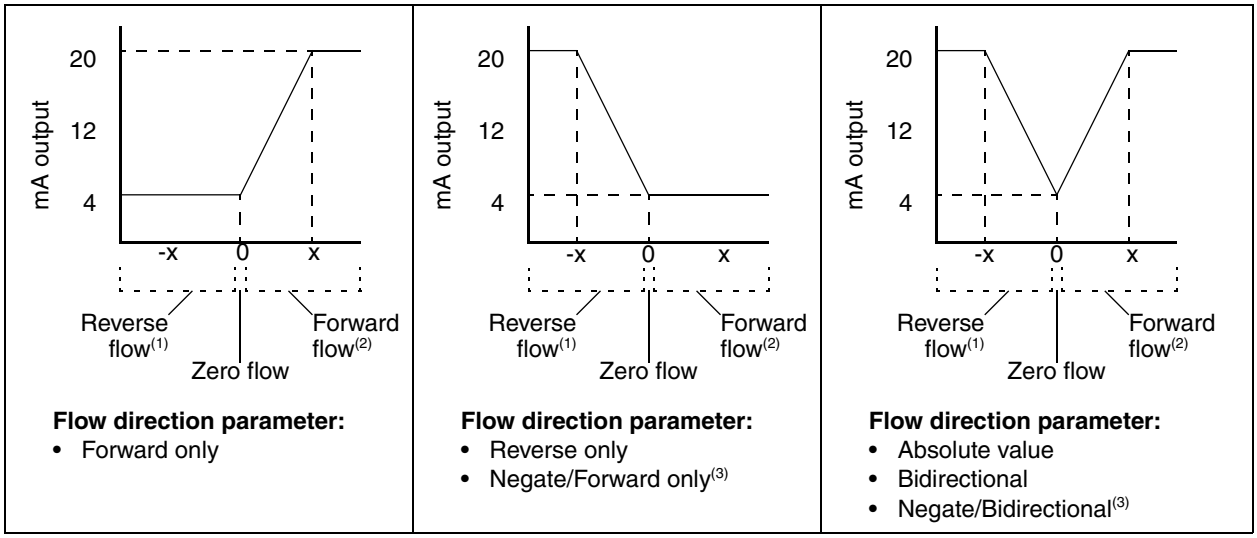
For the effect of flow direction on mA outputs:

- See Figure 8-1 if the 4 mA value of the mA output is set to 0.
- See Figure 8-2 if the 4 mA value of the mA output is set to a negative value.

For a discussion of these figures, see the examples following the figures.

For the effect of flow direction on frequency outputs, totalizers, and flow values reported via digital communication, see Table 8-6.

Figure 8-1 Effect of flow direction on mA outputs: 4mA value = 0

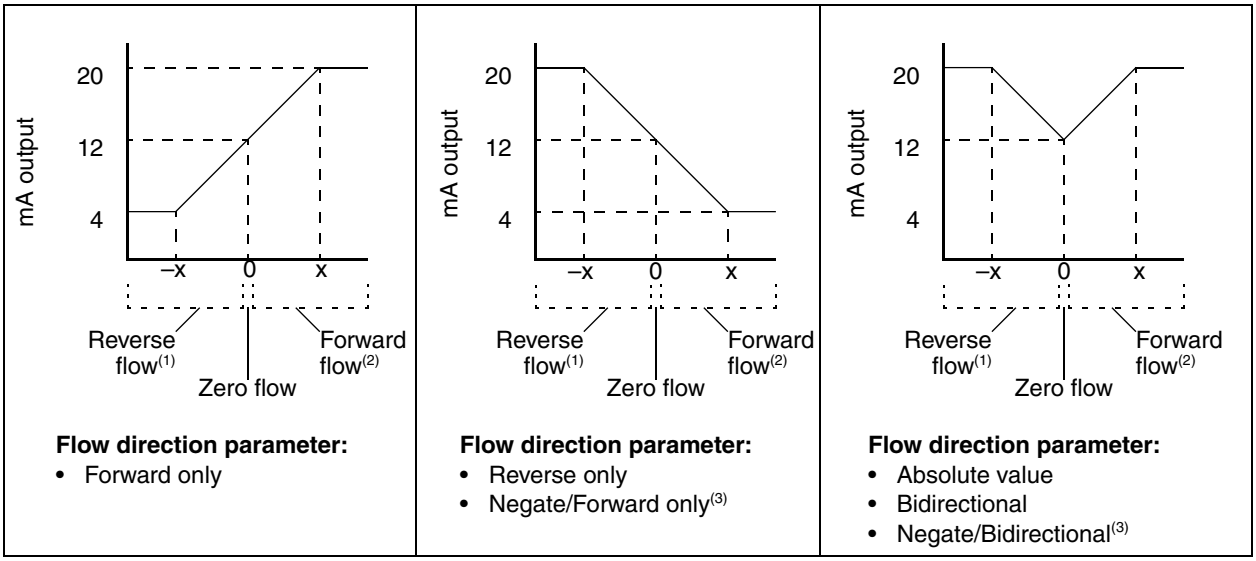


mA output configuration:
- 20 mA value = x
- 4 mA value = 0

To set the 4 mA and 20 mA values, see Section 6.5.2.

(1) Process fluid flowing in opposite direction from flow direction arrow on sensor.
(2) Process fluid flowing in same direction as flow direction arrow on sensor.
(3) Supported only by Model 1500 and Model 2500 transmitters.

Figure 8-2 Effect of flow direction on mA outputs: 4mA value < 0



mA output configuration:
- 20 mA value = x
- 4 mA value = –x
- –x < 0

To set the 4 mA and 20 mA values, see Section 6.5.2.

(1) Process fluid flowing in opposite direction from flow direction arrow on sensor.
(2) Process fluid flowing in same direction as flow direction arrow on sensor.
(3) Supported only by Model 1500 and Model 2500 transmitters.

Example 1

Configuration:

- Flow direction = Forward only
- mA output: 4 mA = 0 g/s; 20 mA = 100 g/s

(See the first graph in Figure 8-1.)

As a result:

- Under conditions of reverse flow or zero flow, the mA output level is 4 mA.
- Under conditions of forward flow, up to a flow rate of 100 g/s, the mA output level varies between 4 mA and 20 mA in proportion to (the absolute value of) the flow rate.
- Under conditions of forward flow, if (the absolute value of) the flow rate equals or exceeds 100 g/s, the mA output will be proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates.

Example 2

Configuration:

- Flow direction = Reverse only
- mA output: 4 mA = 0 g/s; 20 mA = 100 g/s

(See the second graph in Figure 8-1.)

As a result:

- Under conditions of forward flow or zero flow, the mA output level is 4 mA.
- Under conditions of reverse flow, up to a flow rate of 100 g/s, the mA output level varies between 4 mA and 20 mA in proportion to the absolute value of the flow rate.
- Under conditions of reverse flow, if the absolute value of the flow rate equals or exceeds 100 g/s, the mA output will be proportional to the absolute value of the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher absolute values.

Example 3

Configuration:

- Flow direction = Forward only
- mA output: 4 mA = –100 g/s; 20 mA = 100 g/s

(See the first graph in Figure 8-2.)

As a result:

- Under conditions of zero flow, the mA output is 12 mA.
- Under conditions of forward flow, up to a flow rate of 100 g/s, the mA output varies between 12 mA and 20 mA in proportion to (the absolute value of) the flow rate.
- Under conditions of forward flow, if (the absolute value of) the flow rate equals or exceeds 100 g/s, the mA output is proportional to the flow rate up to 20.5 mA, and will be level at 20.5 mA at higher flow rates.
- Under conditions of reverse flow, up to a flow rate of 100 g/s, the mA output varies between 4 mA and 12 mA in inverse proportion to the absolute value of the flow rate.
- Under conditions of reverse flow, if the absolute value of the flow rate equals or exceeds 100 g/s, the mA output is inversely proportional to the flow rate down to 3.8 mA, and will be level at 3.8 mA at higher absolute values.

Table 8-6 Effect of flow direction on frequency outputs, totalizers, and digital communications

	Forward flow(1)		
Flow direction value	**Frequency outputs**	**Flow totals**	**Flow values via digital comm.**
Forward only	Increase	Increase	Positive
Reverse only	0 Hz	No change	Positive
Bidirectional	Increase	Increase	Positive
Absolute value	Increase	Increase	Positive(2)
Negate/Forward only	Zero(2)	No change	Negative
Negate/Bidirectional	Increase	Decrease	Negative
	Reverse flow(3)		
Flow direction value	**Frequency outputs**	**Flow totals**	**Flow values via digital comm.**
Forward only	0 Hz	No change	Negative
Reverse only	Increase	Increase	Negative
Bidirectional	Increase	Decrease	Negative
Absolute value	Increase	Increase	Positive(2)
Negate/Forward only	Increase	Increase	Positive
Negate/Bidirectional	Increase	Increase	Positive

(1) Process fluid flowing in same direction as flow direction arrow on sensor.
(2) Refer to the digital communications status bits for an indication of whether flow is positive or negative.
(3) Process fluid flowing in opposite direction from flow direction arrow on sensor.

8.10 Configuring events

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

An *event* occurs if the real-time value of a user-specfied process variable varies beyond a user-specified value. Events are used to perform specific actions on the applications platform. For example, the event can be defined to activate a discrete output if the flow rate is above a specified value. The discrete output, then, may be configured to close a valve.

You can define one or two events. You may define the events on a single process variable or on two different process variables. Each event is associated with either a high or a low alarm.

Configuring an event includes the following steps:

1. Selecting event 1 or event 2.
2. Assigning a process variable to the event.
3. Specifying an alarm type:
   - *Active high* – alarm is triggered if process variable goes above setpoint
   - *Active low* – alarm is triggered if process variable goes below setpoint
4. Specifying the setpoint – the value at which the event will occur or switch state (ON to OFF, or vice versa).

Note: Events do not occur if the process variable equals the setpoint. The process variable must be greater than (Active high) or less than (Active low) the setpoint for the event to occur.

8.10.1 Reporting event status

There are several ways that event status can be reported:

- If your transmitter has a discrete output, the discrete output can be configured to switch states according to event status (see Section 6.7).
- The display shows Alarm 108 (Event 1 On) or Alarm 109 (Event 2 On).
- Event status can be queried using digital communications:
  - ProLink II automatically displays event information on the **Informational** panel of the **Status** window.
  - The Communicator reports Alarm 108 (Event 1 On) or Alarm 109 (Event 2 On), and also shows event status in **Process Variables/View Status**.

8.11 Configuring slug flow limits and duration

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Slugs—gas in a liquid process or liquid in a gas process—occasionally appear in some applications. The presence of slugs can significantly affect the process density reading. The slug flow parameters can help the transmitter suppress extreme changes in process variables, and can also be used to identify process conditions that require correction.

Slug flow parameters are as follows:

- *Low slug flow limit* – the point below which a condition of slug flow will exist. Typically, this is the lowest density point in your process's normal density range. Default value is 0.0 g/cm^3; range is 0.0–10.0 g/cm^3.
- *High slug flow limit* – the point above which a condition of slug flow will exist. Typically, this is the highest density point in your process's normal density range. Default value is 5.0 g/cm^3; range is 0.0–10.0 g/cm^3.
- *Slug flow duration* – the number of seconds the transmitter waits for a slug flow condition (*outside* the slug flow limits) to return to normal (*inside* the slug flow limits). If the transmitter detects slug flow, it will post a slug flow alarm and hold its last "pre-slug flow" flow rate until the end of the slug flow duration. If slugs are still present after the slug flow duration has expired, the transmitter will report a flow rate of zero. Default value for slug flow duration is 0.0 seconds; range is 0.0–60.0 seconds.

Note: Raising the low slug flow limit or lowering the high slug flow limit will increase the possibility of slug flow conditions.

Note: The slug flow limits must be entered in g/cm^3, even if another unit has been configured for density. Slug flow duration is entered in seconds.

8.12 Configuring fault timeout

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

By default, the transmitter immediately reports a fault when a fault is encountered. You can configure the transmitter to delay reporting a fault by changing the fault timeout to a nonzero value. During the fault timeout period, the transmitter continues to report its last valid measurement.

Note: Although some communication tools allow you to configure the fault timeout in two locations, only one value is stored. If you change the fault timeout in one location, the value displayed on the other location is changed.

8.13 Configuring meter factors

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Meter factors allow you to modify the transmitter's output so that it matches an external measurement standard. Meter factors are used for proving the flowmeter against a Weights & Measures standard. You may need to calculate and configure meter factors periodically to comply with regulations.

You can adjust meter factors for mass flow, volume flow, and density. Only values between 0.8 and 1.2 may be entered. If the calculated meter factor exceeds these limits, contact Micro Motion Customer Service.

8.13.1 Calculating meter factors

Use the following formula to calculate a meter factor:

$$\text{NewMeterFactor} = \text{ConfiguredMeterFactor} \times \frac{\text{ExternalStandard}}{\text{ActualTransmitterMeasurement}}$$

Example

The flowmeter is installed and proved for the first time. The flowmeter mass measurement is 250.27 lb; the reference device measurement is 250 lb. A mass flow meter factor is determined as follows:

$$\text{MassFlowMeterFactor} = 1 \times \frac{250}{250.27} = 0.9989$$

The first mass flow meter factor is 0.9989.

One year later, the flowmeter is proved again. The flowmeter mass measurement is 250.07 lb; the reference device measurement is 250.25 lb. A new mass flow meter factor is determined as follows:

$$\text{MassFlowMeterFactor} = 0.9989 \times \frac{250.25}{250.07} = 0.9996$$

The new mass flow meter factor is 0.9996.

8.14 Configuring the display

- Model 1700 AN
- Model 1700 IS
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

If your transmitter has a display, you can enable or disable specific display functions, set the off-line password, set the auto scroll rate, and specify the process variables to be shown on the display.

8.14.1 Enabling and disabling display parameters

Table 8-7 lists the display parameters and describes their behavior when enabled or disabled.

Table 8-7 Display parameters

Parameter	Enabled	Disabled
Display totalizer start/stop[1]	Operators can start or stop totalizers using the display.	Operators cannot start or stop totalizers using the display.
Totalizer reset[1][2]	Operators can reset the mass and volume totalizers.	Operators cannot reset the mass and volume totalizers.
Auto scroll	The display automatically scrolls through each process variable at a configurable rate.	Operators must **Scroll** to view process variables.
Off-line menu	Operators can access the off-line menu (zero, simulation, and configuration).	Operators cannot access the off-line menu.
Off-line password	Operators must use a password to access the off-line menu.	Operators can access the off-line menu without a password.
Alarm menu	Operators can access the alarm menu (viewing and acknowledging alarms).	Operators cannot access the alarm menu.
Acknowledge all alarms	Operators are able to acknowledge all current alarms at once.	Operators must acknowledge alarms individually.

(1) If the petroleum measurement application is installed on your transmitter, a password is always required to start, stop, or reset a totalizer, even if the off-line password is disabled. If the petroleum measurement application is not installed, a password is never required, even if the off-line password is enabled.

(2) This feature is available only with rev3.3 or higher of the transmitter software. For all other transmitters, totalizer reset and totalizer start/stop from the display cannot be disabled.

8.14.2 Changing the scroll rate

The *scroll rate* is used to control the speed of scrolling when auto scroll is enabled. Scroll rate defines how long each display variable (see Section 8.14.4) will be shown on the display. The time period is defined in seconds; e.g., if scroll rate is set to 10, each display variable will be shown on the display for 10 seconds.

If you are using the Communicator to configure the transmitter, you must enable auto scroll before you can configure scroll rate (see Section 8.14.1).

8.14.3 Changing the off-line password

The off-line password prevents unauthorized users from gaining access to the off-line menu.

The password can contain up to four numbers.

Note: If the petroleum measurement application is enabled on your transmitter, the off-line password will be required for totalizer and inventory control from the display, even if the off-line password is disabled.

If you are using the Communicator, you must enable the off-line password before you can configure it (see Section 8.14.1).

8.14.4 Changing the display variables

The display can scroll through up to 15 process variables in any order. You can configure the process variables to be displayed and the order in which they should appear. The first display variable is permanently set to the process variable assigned to the primary mA output.

Table 8-8 shows an example of a display variable configuration. Notice that you can repeat variables, and you can also specify None. For information on how the display variables will appear on the display, see Appendix J.

Note: When you are configuring display variables, all defined special measurement units will be listed, and can be selected.

Table 8-8 Example of a display variable configuration

Display variable	Process variable
Display variable 1[(1)]	Mass flow
Display variable 2	Mass totalizer
Display variable 3	Volume flow
Display variable 4	Volume totalizer
Display variable 5	Density
Display variable 6	Temperature
Display variable 7	API Std volume flow
Display variable 8	API Std volume total
Display variable 9	External temperature
Display variable 10	External pressure
Display variable 11	Mass flow
Display variable 12	None

Table 8-8 Example of a display variable configuration (continued)

Display variable	Process variable
Display variable 13	None
Display variable 14	None
Display variable 15	None

(1) Display variable 1 always represents the process variable that is assigned to the primary mA output, and cannot be changed.

8.15 Configuring digital communications

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The digital communications parameters control how the transmitter will communicate using digital communications (HART or Modbus).

The following digital communications parameters can be configured:

- Fault indicator
- HART polling address
- Modbus address
- RS-485 settings
- Burst mode
- PV, SV, TV, and QV assignments

8.15.1 Changing the fault indicator

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The transmitter can indicate fault conditions using a digital fault indicator. Table 8-9 lists the options for the digital fault indicator.

Table 8-9 Digital communication fault output indicators and values

ProLink II fault indicator options	Communicator fault indicator options	Fault output value
Upscale	Upscale	Process variables indicate the value is greater than the upper sensor limit. Totalizers stop counting.
Downscale	Downscale	Process variables indicate the value is less than the lower sensor limit. Totalizers stop counting.
Zero	IntZero-All 0	Flow rates, density, and temperature go to the value that represents zero flow. Totalizers stop counting.
Not-A-Number (NAN)	Not-a-Number	Process variables report IEEE NAN and Modbus scaled integers report **Max Int**. Totalizers stop counting.
Flow to Zero	IntZero-Flow 0	Flow rates go to the value that represents zero flow; other process variables are not affected. Totalizers stop counting.
None (default)	None	Process variables reported as measured.

8.15.2 Changing the HART polling address

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The transmitter's HART polling address is used by devices on a network to identify and communicate with the transmitter using HART protocol. The HART polling address must be unique on the network. If the transmitter will not be accessed using HART protocol, the HART polling address is not required.

The HART polling address is used for both HART/Bell202 and HART/RS485 communications; i.e., for HART communication over either the primary mA output terminals or the RS-485 terminals (AN transmitters only).

Note: Devices using HART protocol to communicate with the transmitter may use either the HART polling address or the HART tag (see Section 8.16) . You may configure either or both, as required by your other HART devices.

Valid HART polling addresses are 0–15.

Zero is a special-purpose polling address that enables the primary mA output to vary according to the assigned process variable. When a transmitter's HART polling address is set to any value other than zero, the primary mA output is fixed at 4 mA, and will not report any variation in the assigned process variable.

8.15.3 Changing the Modbus address

- Model 1500 AN
- Model 1700 AN
- Model 2500 CIO
- Model 2700 AN

The transmitter's Modbus address is used by devices on a network to identify and communicate with the transmitter using Modbus protocol. The Modbus address must be unique on the network. If the transmitter will not be accessed using Modbus protocol, the Modbus address is not required.

Valid Modbus addresses are:

- 1–15
- 32–47
- 64–79
- 96–110

Note: If you are using ProLink II, and you are connected to the transmitter over a Modbus connection, ProLink II will lose communication as soon as you click the Apply button. To reestablish communication, you must change the communication settings specified in the ProLink II Connect dialog box (see Chapter 3). This does not apply to service port connections.

8.15.4 Changing the RS-485 parameters

- Model 1500 AN
- Model 1700 AN
- Model 2500 CIO
- Model 2700 AN

RS-485 parameters control how the transmitter will communicate over its RS-485 terminals. The RS-485 parameters are listed in Table 8-10.

Table 8-10 RS-485 communication settings

	Transmitter	
Parameter	**1500 AN / 2500 CIO options**	**1700 AN / 2700 AN options**
Protocol	Modbus ASCII Modbus RTU (default)	Modbus ASCII Modbus RTU (default) HART
Parity	Odd (default) Even None	Odd (default) Even None
Stop bits	1 (default) 2	1 (default) 2
Baud rate	1200 to 38,400 (default: 9600)	1200 to 38,400 (default: 9600)

To enable RS-485 communications with the transmitter from a remote device:

1. Set the transmitter's digital communications parameters appropriately for your network.
2. Configure the remote device to use the specified parameters.

Note: Changing the RS-485 communication settings does not affect service port connections. Service port connections always use default settings.

Note: In some versions of ProLink II, a button named **Choose Typical HART Settings** *is provided. When this button is pressed, the settings for the RS-485 terminals are changed to the most common settings used for HART communications:*

- *Protocol: HART*
- *Parity: Odd*
- *Baud Rate: 1200*
- *Stop Bits: 1*

Note the following when setting RS-485 parameters:

- If HART protocol is selected, setting the address to any number other than 0 automatically fixes the mA output at 4 mA. To allow the mA output to vary with the assigned process variable, this address must be set to 0.
- If you are using ProLink II, and you are connected to the transmitter over a Modbus RS-485 connection, ProLink II will lose communication as soon as you click the **Apply** button. To reestablish communication, you must change the ProLink II communication settings to match the settings configured in the transmitter.
- If you are using the display:
  - And the off-line menu has been disabled, you will not be able to change the RS-485 options with the display. For information about enabling and disabling the off-line menu, see Section 8.14.1.
  - The address item allows users to enter the polling address. Valid addresses depend on the protocol selected earlier. Valid addresses for Modbus protocol must be in one of the following ranges: 1–15, 32–47, 64–79, or 96–110. Valid addresses for HART protocol must be in the range 0–15. If Protocol is set to **NONE**, the address item will not appear.

8.15.5 Configuring HART burst mode

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Burst mode is a specialized mode of communication during which the transmitter regularly broadcasts HART digital information over the primary mA output. Burst mode is ordinarily disabled, and should be enabled only if another device on the network requires HART burst mode communication.

To configure burst mode:

1. Enable burst mode.
2. Specify the burst mode output. Options are described in Table 8-11.

Table 8-11 Burst mode output options

Parameter		
ProLink II label	**Communicator label**	**Definition**
Primary variable	PV	The transmitter repeats the primary variable (in measurement units) in each burst (e.g., 14.0 g/s, 13.5 g/s, 12.0 g/s).
PV current & % of range	% range/current	The transmitter sends the PV's percent of range and the PV's actual mA level in each burst (e.g., 25%, 11.0 mA).
Dynamic vars & PV current(1)	Process variables/current	The transmitter sends PV, SV, TV, and quaternary variable (QV) values in measurement units and the PV's actual milliamp reading in each burst (e.g., 50 lb/min, 23 °C, 50 lb/min, 0.0023 g/cm^3, 11.8 mA).
Transmitter vars	Fld dev var	The transmitter sends four process variables in each burst. See Step 3.

(1) This burst mode setting is typically used with the HART Tri-Loop™ signal converter. See the Tri-Loop manual for additional information.

3. If you specified **Transmitter vars** or **Fld dev var** in Step 2, use ProLink II or the 375 Field Communicator to specify the four process variables to be sent in each burst.

Note: If you are using the 275 HART Communicator to configure the transmitter, you cannot change the default.

8.15.6 Configuring the PV, SV, TV, and QV assignments

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

In the transmitter, four variables are defined for HART communications: the PV (primary variable), the SV (secondary variable), the TV (tertiary variable), and the QV (quaternary variable). A process variable such as mass flow is assigned to each HART variable.

The values of the assigned process variables can be reported or read in several ways:

- The PV is automatically reported through the primary mA output. It can also be queried via digital communications or reported via burst mode. If you change the PV, the process variable assigned to the primary mA output is changed automatically, and vice versa. See Section 6.5.1.
- The SV is automatically reported through the secondary mA output, if the transmitter has a secondary mA output. It can also be queried via digital communications or reported via burst mode. If you change the SV, the process variable assigned to the secondary mA output is changed automatically, and vice versa. See Section 6.5.1.
- The TV is automatically reported through the frequency output, if the transmitter has a frequency output. It can also be queried via digital communications or reported via burst mode. If you change the TV, the process variable assigned to the frequency output is changed automatically, and vice versa. See Section 6.6.1.
- The QV is not reported through an output. It can be queried via digital communications or reported via burst mode.

Table 8-11 lists the valid process variable assignments for the PV, SV, TV, and QV on Series 1000 and Series 2000 transmitters.

Note: Series 1000 transmitters support only flow variables on all outputs.

Table 8-12 Process variable assignments for PV, SV, TV, and QV

	Series 1000				Series 2000			
Process variable[1]	**PV**	**SV**	**TV**	**QV**	**PV**	**SV**	**TV**	**QV**
Mass flow	✓	✓	✓	✓	✓	✓	✓	✓
Volume flow	✓	✓	✓	✓	✓	✓	✓	✓
Temperature					✓	✓		✓
Density					✓	✓		✓
Drive gain					✓	✓		✓
Mass total				✓				✓
Volume total				✓				✓
Mass inventory				✓				✓
Vol inventory				✓				✓
External pressure								✓
External temperature								✓
Average temperature (API)					✓	✓		✓

Table 8-12 Process variable assignments for PV, SV, TV, and QV (continued)

Process variable[1]	Series 1000 PV	Series 1000 SV	Series 1000 TV	Series 1000 QV	Series 2000 PV	Series 2000 SV	Series 2000 TV	Series 2000 QV
Standard volume flow (API)					✓	✓	✓	✓
Standard density (API)					✓	✓		✓
Standard volume total (API)								✓
Standard volume inventory (API)								✓
Average corrected density (API)					✓	✓		✓
CTL (API)								✓

(1) API process variables are available only if the petroleum measurement application has been installed on the transmitter. If the enhanced density application has been installed, enhanced density process variables will be available.

8.16 Configuring device settings

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The device settings are used to describe the flowmeter components. Table 8-13 lists and defines the device settings.

Note: The HART device ID, which is displayed in some menus, can be set only once, and is usually set at the factory to the device serial number. If the HART device ID has not been set, its value is 0.

Table 8-13 Device settings

Parameter	Description
HART tag[1]	Also called the "software tag." Used by other devices on the network to identify and communicate with this transmitter via HART protocol. The HART tag must be unique on the network. If the transmitter will not be accessed using HART protocol, the HART tag is not required. Maximum length: 8 characters.
Descriptor	Any user-supplied description. Not used in transmitter processing, and not required. Maximum length: 16 characters.
Message	Any user-supplied message. Not used in transmitter processing, and not required. Maximum length: 32 characters.
Date	Any user-selected date. Not used in transmitter processing, and not required.

(1) Devices using HART protocol to communicate with the transmitter may use either the HART address (see Section 8.15.2) or the HART tag. You may configure either or both, as required by your other HART devices.

If you are entering a date:

- With ProLink II, use the left and right arrows at the top of the calendar to select the year and month, then click on a date
- With a Communicator, enter a value in the form *mm/dd/yyyy*

8.17 Configuring sensor parameters

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The sensor parameters are used to describe the sensor component of your flowmeter. They are not used in transmitter processing, and are not required. The following sensor parameters can be changed:

- Serial number
- Model number
- Sensor material
- Liner material
- Flange

Chapter 9
Pressure Compensation, Temperature Compensation, and Polling

9.1 Overview

This chapter describes the following procedures:

- Configuring pressure compensation (see Section 9.2)
- Configuring external temperature compensation (see Section 9.3)
- Configuring polling (see Section 9.4)

Note: All ProLink II procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Chapter 3 for more information.

Note: All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

9.2 Pressure compensation

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Series 1000/2000 transmitters can compensate for the effect of pressure on the sensor flow tubes. *Pressure effect* is defined as the change in sensor flow and density sensitivity due to process pressure change away from calibration pressure.

Note: Pressure compensation is an optional procedure. Perform this procedure only if required by your application.

9.2.1 Options

There are two ways to configure pressure compensation:

- If the operating pressure is a known static value, you can enter the external pressure in the software, and not poll a pressure measurement device.
- If the operating pressure varies significantly, you configure the transmitter to poll for an updated pressure value from an external pressure measurement device. Polling requires HART/Bell202 communications over the primary mA output.

Note: If you configure a static pressure value, ensure that it is accurate. If you configure polling for pressure, ensure that the pressure measurement device is accurate and reliable.

9.2.2 Pressure correction factors

When configuring pressure compensation, you must provide the flow calibration pressure—the pressure at which the flowmeter was calibrated (which therefore defines the pressure at which there will be no effect on the calibration factor). Micro Motion calibrates flowmeters at the factory to National Institute of Standards and Technology (NIST) standards (20 psi).

Two additional pressure correction factors may be configured: one for flow and one for density. These are defined as follows:

- Flow factor – the percent change in the flow rate per psi
- Density factor – the change in fluid density, in $g/cm^3/psi$

Not all sensors or applications require pressure correction factors. For a discussion of pressure effect, see the $EXPERT_2$ system at www.expert2.com. For the pressure correction values to be used, obtain the pressure effect values from the product data sheet for your sensor, then reverse the signs (e.g., if the pressure effect is 0.000004, enter a pressure correction factor of –0.000004).

9.2.3 Pressure measurement unit

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

The default measurement unit for pressure is **PSI**. In other words, the transmitter expects to receive pressure data in PSI.

If you will use a different pressure measurement unit, you must configure the transmitter to use that measurement unit. To access the pressure measurement unit parameter, see the menu flowcharts for your transmitter.

See Table 9-1 for a complete list of pressure measurement units.

Table 9-1 Pressure measurement units

Pressure unit		
ProLink II	**Communicator**	**Unit description**
In Water @ 68F	inH2O	Inches water @ 68 °F
In Mercury @ 0C	inHg	Inches mercury @ 0 °C
Ft Water @ 68F	ftH2O	Feet water @ 68 °F
mm Water @ 68F	mmH2O	Millimeters water @ 68 °F
mm Mercury @ 0C	mmHG	Millimeters mercury @ 0 °C
PSI	psi	Pounds per square inch
bar	bar	Bar
millibar	mbar	Millibar
g/cm2	g/Sqcm	Grams per square centimeter
kg/cm2	kg/Sqcm	Kilograms per square centimeter
pascals	Pa	Pascals
Kilopascals	kPa	Kilopascals
Torr @ 0C	torr	Torr @ 0 °C
atms	atms	Atmospheres

9.2.4 Configuration

You can enable and configure pressure compensation with ProLink II or the Communicator.

With ProLink II

To enable and configure pressure compensation with ProLink II:

1. Ensure that the pressure measurement unit is set correctly (see Section 9.2.3).
2. From the **View** menu, select **Preferences**.
3. If the **Enable External Pressure Compensation** checkbox does not already contain a check mark, click the checkbox, then click **Apply**.
4. From the **ProLink** menu, open the **Configuration** panel and click the **Pressure** tab.
5. Enter new values in the **Flow factor**, **Density factor**, and **Cal Pressure** boxes. See the discussion in Section 9.2.2. Click **Apply**.
6. If you will poll an external device for pressure data, follow the polling setup instructions in Section 9.4.
7. If you will use a static pressure value:
   a. Ensure that polling for pressure is not configured. Polling for temperature is allowed. See Section 9.4.
   b. Enter the pressure value in the **External Pressure** box.
8. Click **Apply**.

With a Communicator

To enable and configure pressure compensation with a Communicator:

1. Ensure that the pressure measurement unit is set correctly (see Section 9.2.3).
2. Press **4, 1**.
3. Select **Pressure Comp**.
4. Select **Enable Pressure Co**.
   a. If it is not already selected, select **Enabled**.
   b. Press **ENTER**.
5. Select **Flow fctr**.
   a. Enter a new flow factor. See the discussion in Section 9.2.2.
   b. Press **ENTER**.
6. Select **Dens factr**.
   a. Enter a new density factor. See the discussion in Section 9.2.2.
   b. Press **ENTER**.
7. Select **Flowcal pressure**.
   a. Enter a new flowcal pressure. See the discussion in Section 9.2.2.
   b. Press **ENTER**.
8. If you will poll an external device for pressure data:
   a. Press **SEND**.
   b. Press **HOME**.
   c. Follow the polling setup instructions in Section 9.4.

9. If you will use a static pressure value:
   a. Ensure that polling for pressure is not configured. Polling for temperature is allowed. See Section 9.4.
   b. Select **Static pressure**.
   c. Enter the static pressure.
   d. Press **ENTER**.
   e. Press **SEND**.
   f. Press **HOME**.

9.3 External temperature compensation

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Temperature data are used in several different calculations. Micro Motion sensors always report temperature data to the transmitter. For greater accuracy, you can configure the transmitter to use a different temperature value.

There are two ways to configure external temperature compensation:

- If the operating temperature is a known static value, you can enter the operating temperature in the software, and not poll a temperature measurement device.
- If the operating temperature varies significantly, you configure the transmitter to poll for an updated temperature value from an external temperature measurement device. Polling requires HART/Bell202 communications over the primary mA output.

Note: If your core processor is v2.1 or earlier, and you configure the transmitter for external temperature compensation, the temperature value from the compensation procedure will replace the sensor value in all calculations that require temperature data. If your core processor is v2.2 or later, the temperature value from the compensation procedure is used only for enhanced density and petroleum measurement calculations.

Note: If you configure a static temperature value, ensure that it is accurate. If you configure polling for temperature, ensure that the external temperature measurement device is accurate and reliable.

You can configure external temperature compensation with ProLink II or the Communicator.

With ProLink II

To configure external temperature compensation with ProLink II:

1. From the **View** menu, select **Preferences**.
2. If the **Use External Temperature** checkbox does not already contain a checkmark, click the checkbox, then click **Apply**.
3. If you will poll an external device for temperature data:
   a. Ensure that the transmitter is configured to use the same temperature measurement unit that the external temperature measurement device uses (see Section 6.4).
   b. Follow the polling setup instructions in Section 9.4.

4. If you will use a static temperature value:
   a. Ensure that polling for temperature is not configured. Polling for pressure is allowed. See Section 9.4.
   b. From the **ProLink** menu, open the **Configuration** panel and click the **Temperature** tab.
   c. Enter the temperature value in the **External Temperature** box.
5. Click **Apply**.

With a Communicator

To configure external temperature compensation with a Communicator:

1. Press **4, 1**.
2. Select **Ext Temp**.
   a. Select **Enable Ext Temp**.
   b. Select **Enabled**.
   c. Press **ENTER**.
3. If you will poll an external device for temperature data:
   a. Press **SEND**.
   b. Press **HOME**.
   c. Ensure that the transmitter is configured to use the same temperature measurement unit that the external temperature measurement device uses (see Section 6.4).
   d. Follow the polling setup instructions in Section 9.4.
4. If you will use a static temperature value:
   a. Ensure that polling for temperature is not configured. Polling for pressure is allowed. See Section 9.4.
   b. Select **Static temperature**.
   c. Enter the static temperature value.
   d. Press **ENTER**.
   e. Press **SEND**.
   f. Press **HOME**.

9.4 Configuring polling

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Polling is used to retrieve temperature or pressure data from an external device.

- If you have core processor v2.1 and earlier, the polled temperatuare value is used for all calculations that require a temperature value.
- If you have core processor v2.2 or later, the polled temperature value is used only for calculation of the derived variable in enhanced density applications or the CTL value in petroleum measurement applications. The temperature value from the sensor is used for all other calculations that require a temperature value.

You may query one or two external devices.

Polling requires HART protocol over the Bell 202 physical layer. You must ensure that the primary mA output has been wired for HART protocol. See the installation manual for your transmitter.

You can configure polling with ProLink II or the Communicator.

With ProLink II

To configure polling with ProLink II:

1. Verify that pressure compensation or external temperature compensation has been enabled (see Section 9.2 and Section 9.3).
2. If you are polling for temperature, open the **Configuration** panel from the **ProLink** menu, click the **Temperature** tab, and ensure that the **External Temperature** value has not been set. The default value is 32.00 °F (0 °C). Click **Apply** if necessary.
3. Click the **Polled Variables** tab.
4. For Polled Variable 1:
   a. Click the arrow in the **Polling Control** box, and select a HART polling method from the list. Choose **Primary** if the external device will probably be accessed by another device acting as a secondary master (e.g., a Communicator). Choose **Secondary** if the external device will probably be accessed by another device acting as a primary master.

Note: If you are configuring both Polled Variable 1 and Polled Variable 2, use the same Polling Control setting for both. If you do not, Poll as Primary will be used for both devices.

   b. Click **Apply**. The additional polling parameters are now available for configuration.
   c. In the **External Tag** box, enter the HART tag of the external device that you will poll.
   d. Click the arrow in the **Variable Type** box, and select a process variable.
   e. Click **Apply**.
5. Repeat these steps for Polled Variable 2, if required.

With a Communicator

To configure polling with a Communicator:

1. Verify that pressure compensation or external temperature compensation has been enabled (see Section 9.2 and Section 9.3).
2. Press **4, 1**.
3. Select **Polling Setup**.
4. Select **Poll Control 1**.
   a. Select a HART polling method from the list. Choose **Primary** if the external device will probably be accessed by another device acting as a secondary master (e.g., a Communicator). Choose **Secondary** if the external device will probably be accessed by another device acting as a primary master.
   b. Press **ENTER**.

Note: If you are configuring both Polled Variable 1 and Polled Variable 2, use the same Polling Control setting for both. If you do not, Poll as Primary will be used for both devices.

5. Select **Ext Dev Tag 1**.
   a. Enter the HART tag of the external device to be polled.
   b. Press **ENTER**.

6. Select **Polled Var 1**.
   a. Select the value to be retrieved.
   b. Press **ENTER**.
7. Repeat these steps for Polled Variable 2, if required.
8. Press **SEND**.
9. Press **HOME**.

Chapter 10
Troubleshooting

10.1 Overview

This chapter describes guidelines and procedures for troubleshooting the flowmeter. The information in this chapter will enable you to:

- Categorize the problem
- Determine whether you are able to correct the problem
- Take corrective measures (if possible)
- Contact the appropriate support agency

Note: All ProLink II procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Chapter 3 for more information.

⚠ WARNING

Using the service port to communicate with the transmitter in a hazardous area can cause an explosion.

Before using the service port to communicate with the transmitter in a hazardous area, make sure the atmosphere is free of explosive gases.

Note: All Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

10.2 Guide to troubleshooting topics

Refer to Table 10-1 for a list of troubleshooting topics discussed in this chapter.

Table 10-1 Troubleshooting topics and locations

Section	Topic
Section 10.4	*Transmitter does not operate*
Section 10.5	*Transmitter does not communicate*
Section 10.6	*Zero or calibration failure*
Section 10.7	*Fault conditions*
Section 10.8	*HART output problems*
Section 10.9	*Milliamp and frequency output problems*

Table 10-1 Troubleshooting topics and locations (continued)

Section	Topic
Section 10.10	*Transmitter status LED*
Section 10.11	*Status alarms*
Section 10.13	*Diagnosing wiring problems*
Section 10.13.1	*Checking the power supply wiring*
Section 10.13.2	*Checking the sensor-to-transmitter wiring*
Section 10.13.4	*Checking for RF interference*
Section 10.13.5	*Checking the HART communication loop*
Section 10.14	*Checking the communication device*
Section 10.15	*Checking the output wiring and receiving device*
Section 10.12	*Checking process variables*
Section 10.16	*Checking slug flow*
Section 10.17	*Checking output saturation*
Section 10.18	*Setting the HART polling address to zero*
Section 10.19	*Checking the flow measurement unit*
Section 10.20	*Checking the upper and lower range values*
Section 10.21	*Checking the frequency output scale and method*
Section 10.22	*Checking the characterization*
Section 10.23	*Checking the calibration*
Section 10.24	*Checking the test points*
Section 10.25	*Checking the core processor*
Section 10.26	*Checking sensor coils and RTD*

10.3 Micro Motion customer service

Micro Motion provides an online troubleshooting system. To use it, go to www.expert2.com.

To speak to a customer service representative, contact the Micro Motion Customer Service Department. Contact information is provided on the title page of this manual.

Before contacting Micro Motion customer service, review the troubleshooting information and procedures in this chapter, and have the results available for discussion with the technician.

10.4 Transmitter does not operate

If the transmitter does not operate at all (i.e., the transmitter is not receiving power and cannot communicate over the HART network, or the status LED is not lit), perform all of the procedures in Section 10.13.

If the procedures do not indicate a problem with the electrical connections, contact the Micro Motion Customer Service Department. See Section 10.3.

10.5 Transmitter does not communicate

If the transmitter does not appear to be communicating on the HART network, the network wiring may be faulty. Perform the procedures in Section 10.13.5.

10.6 Zero or calibration failure

If a zero or calibration procedure fails, the transmitter will send a status alarm indicating the cause of failure. See Section 10.11 for specific remedies for status alarms indicating calibration failure.

10.7 Fault conditions

If the analog or digital outputs indicate a fault condition (by transmitting a fault indicator), determine the exact nature of the fault by checking the status alarms with a Communicator or ProLink II software, or the display if available on your transmitter. Once you have identified the status alarm(s) associated with the fault condition, refer to Section 10.11.

Some fault conditions can be corrected by cycling power to the transmitter. A power cycle can clear the following:

- Loop test
- Zero failure
- Stopped internal totalizer

(Model 1700/2700 transmitters only) After cycling power, an A107 alarm will be reported and the status LED will be flashing. This indicates that a power reset has occurred, and is normal. Acknowledge the alarm as described in Section 7.7.

10.8 HART output problems

HART output problems include inconsistent or unexpected behavior that does not trigger status alarms. For example, the Communicator might show incorrect units of measure or respond sluggishly. If you experience HART output problems, verify that the transmitter configuration is correct.

If you discover that the configuration is incorrect, change the necessary transmitter settings. See Chapter 6 and Chapter 8 for the procedures to change the appropriate transmitter settings.

If you confirm that all the settings are correct, but the unexpected outputs continue, the transmitter or sensor could require service. See Section 10.3.

10.9 Milliamp and frequency output problems

If you are experiencing problems with the mA or frequency outputs, use Table 10-2 to identify an appropriate remedy.

Table 10-2 Milliamp and frequency output problems and remedies

Symptom	Possible cause	Possible remedy
No output Loop test failed	Power supply problem	Check power supply and power supply wiring. See Section 10.13.1.
	Fault condition present if fault indicators are set to downscale or internal zero	Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.5.4 to check the mA fault indicator, or Section 6.6.6 to check the frequency fault indicator. If a fault condition is present, see Section 10.7.
	Channel not configured for desired output (CIO transmitters, Channel B or C only)	Verify channel configuration for associated output terminals.

Table 10-2 Milliamp and frequency output problems and remedies (continued)

Symptom	Possible cause	Possible remedy
mA output < 4 mA	Process condition below LRV	Verify process. Change the LRV. See Section 6.5.2.
	Fault condition if fault indicator is set to internal zero	Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.5.4. If a fault condition is present, see Section 10.7.
	Open in wiring	Verify all connections.
	Bad mA receiving device	Check the mA receiving device or try another mA receiving device. See Section 10.15.
	Channel not configured for mA operation (CIO transmitters only)	Verify channel configuration.
	Bad output circuit	Measure DC voltage across output to verify that output is active.
	Output not powered (IS transmitters only)	Check transmitter wiring. See Appendix B for diagrams.
No frequency output	Process condition below cutoff	Verify process. Change the cutoff. See Section 8.6.
	Fault condition if fault indicator is set to downscale or internal zero	Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.6.6. If a fault condition is present, see Section 10.7.
	Slug flow	See Section 10.16.
	Flow in reverse direction from configured flow direction parameter	Verify process. Check flow direction parameter. See Section 8.9. Verify sensor orientation. Ensure that flow direction arrow on sensor case matches process flow.
	Bad frequency receiving device	Check the frequency receiving device or try another frequency receiving device. See Section 10.15.
	Incorrect terminal configuration	FO can be configured on different terminals. Verify configuration.
	Output level not compatible with receiving device	See your transmitter installation manual. Verify that the output level and the required receiving input level are compatible.
	Bad output circuit	Perform loop test. See Section 5.3.
	Incorrect internal/external power configuration	Internal means that the transmitter will supply power. External means that an external pull-up resistor and source are required. Refer to your transmitter installation manual for wiring. Verify configuration is correct for desired application (see Section 6.3).
	Incorrect pulse width configuration	Verify pulse width setting. See Section 6.6.3.
	Output not powered (IS transmitters only)	Check transmitter wiring. See Appendix B for diagrams.

Table 10-2 Milliamp and frequency output problems and remedies (continued)

Symptom	Possible cause	Possible remedy
Constant mA output	Non-zero HART address (multi-drop communications) (primary mA output only)	Set HART address to zero. See Section 10.18.
	Output is fixed in a test mode	Exit output from test mode. See Section 5.3.
	Burst mode enabled (primary mA output only)	Disable burst mode. See Section 8.15.5.
	Zero calibration failure	Cycle power. Stop flow and rezero. See Section 5.5.
mA output consistently out of range	Fault condition if fault indicator is set to upscale or downscale	Check the fault indicator settings to verify whether or not the transmitter is in a fault condition. See Section 6.5.4. If a fault condition is present, see Section 10.7.
	LRV and URV not set correctly	Check the LRV and URV. See Section 10.20.
Consistently incorrect mA measurement	Output not trimmed correctly	Trim the output. See Section 5.4.
	Incorrect flow measurement unit configured	Verify flow measurement unit configuration. See Section 10.19.
	Incorrect process variable configured	Verify process variable assigned to mA output. See Section 6.5.1.
	LRV and URV not set correctly	Check the LRV and URV. See Section 10.20.
mA reading correct at low currents but wrong at higher currents	mA loop resistance may be too high	Verify mA output 1 or mA output 2 load resistance is below maximum supported load (see installation manual for your transmitter).
Consistently incorrect frequency measurement	Output not scaled correctly	Check frequency output scale and method. See Section 10.21. Verify voltage and resistance match the frequency output load resistance value chart (see your transmitter installation manual).
	Incorrect flow measurement unit configured	Verify flow measurement unit configuration. See Section 10.19.
Erratic frequency measurement	RF (radio frequency) interference from environment	See Section 10.13.4.
Cannot zero with Zero button (Model 1500/2500 transmitters only)	Not pressing Zero button for sufficient interval	Button must be depressed for .5 seconds to be recognized. Depress button until LED starts to flash yellow, then release button.
	Core processor in fault mode	Correct core processor faults and retry.
Cannot connect to terminals 33 & 34 in service port mode (Model 1500/2500 transmitters only)	Terminals not in service port mode	Terminals are accessible in service port mode ONLY for a 10-second interval after power-up. Cycle power and connect during this interval.
	Leads reversed.	Switch leads and try again.
	Transmitter installed on multidrop network	All Model 2500 devices on network default to address=111 during 10-second service port interval. Disconnect or power down other devices, or use RS-485 communications.
Cannot establish Modbus communication on terminals 33 & 34 (Model 1500/2500 transmitters only)	Incorrect Modbus configuration	After 10-second interval on power-up, the transmitter switches to Modbus communications. Default settings are: • Address=1 • Baud rate=9600 • Parity=odd Verify configuration. Default settings can be changed using ProLink II v2.0 or higher.
	Leads reversed	Switch leads and try again.

Table 10-2 Milliamp and frequency output problems and remedies (continued)

Symptom	Possible cause	Possible remedy
FO phase on Channel C does not change with flow direction (Config IO transmitters only)	Wrong configuration setting	FO mode must be set to Quadrature for phase to automatically track flow direction.
DI is fixed and does not respond to input switch (Config IO transmitters only)	Possible internal/external power configuration error	Internal means that the Configurable I/O will supply power. External means that an external pull-up resistor and source are required. Verify configuration setting is correct for desired application.
Cannot configure Channel B for DO1 operation (Config IO transmitters only)	Channel C is configured as FO	FO and DO1 use the same circuitry and cannot run simultaneously. Configure Channel B as FO and Channel C as DO2.
Cannot configure Channel C for FO operation (Config IO transmitters only)	Channel B is configured as DO1	FO and DO1 use the same circuitry and cannot run simultaneously. Configure Channel B as FO and Channel C as DO2.

10.10 Transmitter status LED

10.10.1 Model 1500/2500 transmitters

The Model 1500/2500 transmitter includes a LED that indicates transmitter status. See Table 10-3.

If the status LED indicates an alarm condition:

1. View the alarm code using ProLink II or a Communicator.
2. Identify the alarm (see Section 10.11).
3. Correct the condition.

Table 10-3 Model 1500/2500 transmitter status reported by the status LED

Status LED state	Alarm priority	Definition
Green	No alarm	Normal operating mode
Flashing yellow	No alarm	Zero in progress
Yellow	Low severity alarm	• Alarm condition: will not cause measurement error • Outputs continue to report process data
Red	High severity alarm	• Alarm condition: will cause measurement error • Outputs go to configured fault indicators

10.10.2 Model 1700/2700 transmitters with displays

The display on the Model 1700/2700 transmitter includes a LED that indicates transmitter status. See Table 10-4.

If the status LED indicates an alarm condition:

1. View the alarm code using the procedures described in Section 7.6.
2. Identify the alarm (see Section 10.11).
3. Correct the condition.
4. If required, acknowledge the alarm using the procedures described in Section 7.7.

Table 10-4 Model 1700/2700 transmitter status reported by the status LED

Status LED state	Alarm priority
Green	No alarm—normal operating mode
Flashing green(1)	Unacknowledged corrected condition
Yellow	Acknowledged low severity alarm
Flashing yellow(1)	Unacknowledged low severity alarm
Red	Acknowledged high severity alarm
Flashing red(1)	Unacknowledged high severity alarm

(1) If access to the alarm menu from the display has been disabled, it is not necessary to acknowledge alarms. In this case, the status LED will never flash. See Section 8.14.1 for information about enabling and disabling this display function.

10.11 Status alarms

Status alarm codes are reported on the display (for transmitters that have displays), and status alarms can be viewed with ProLink II or the Communicator. A list of status alarms and possible remedies is provided in Table 10-5.

Table 10-5 Status alarms and remedies

Alarm code	Communicator	ProLink II software	Possible remedy
A1	EEPROM Checksum—Core Processor	EEPROM Checksum	Cycle power to the flowmeter.
			The flowmeter might need service. Contact Micro Motion. See Section 10.3.
A2	RAM Error—Core Processor	RAM Error	Cycle power to the flowmeter.
			The flowmeter might need service. Contact Micro Motion. See Section 10.3.
A3	Sensor failure	Sensor Failure	Check the test points. See Section 10.24.
			Check the sensor coils. See Section 10.26.
			Check wiring to sensor. See Section 10.13.2.
			Check for slug flow. See Section 10.16.
			Check sensor tubes.
A4	Temperature out of range	Temperature Overrange	Check the test points. See Section 10.24.
			Check the sensor RTD reading(s). See Section 10.26.
			Check wiring to sensor. See Section 10.13.2.
			Verify flowmeter characterization. See Section 6.2.
			Verify that process temperature is within range of sensor and transmitter.
			Contact Micro Motion. See Section 10.3.

Table 10-5 Status alarms and remedies (continued)

Alarm code	Communicator	ProLink II software	Possible remedy
A5	Input over range	Input Overrange	Check the test points. See Section 10.24.
			Check the sensor coils. See Section 10.26.
			Verify process.
			Make sure that the appropriate measurement unit is configured. See Section 10.19.
			Verify 4 mA and 20 mA values. See Section 10.20.
			Verify calibration factors in transmitter configuration. See Section 6.2.
			Re-zero the transmitter.
A6	Field device not characterized	Not Configured	Check the characterization. Specifically, verify the FCF and K1 values. See Section 6.2.
			If the problem persists, contact Micro Motion. See Section 10.3.
A7	Real time interrupt failure	RTI Failure	Cycle power to the flowmeter.
			The flowmeter might need service. Contact Micro Motion. See Section 10.3.
A8	Density outside limits	Density Overrange	Check the test points. See Section 10.24.
			Check the sensor coils. See Section 10.26.
			Verify process. Check for air in the flow tubes, tubes not filled, foreign material in tubes, or coating in tubes.
			Verify calibration factors in transmitter configuration. See Section 6.2.
			Perform density calibration. See Section C.3.
A9	Field device warming up	Transmitter Initializing	Allow the flowmeter to warm up. The error should disappear once the flowmeter is ready for normal operation. If alarm does not clear, make sure that the sensor is completely full or completely empty. Verify sensor configuration and wiring to sensor.
A10	Calibration failed	Calibration Failure	If alarm appears during a transmitter zero, ensure that there is no flow through the sensor, then retry.
			Cycle power to the flowmeter, then retry.
A11	Excess calibration correction, zero too low	Zero too Low	Ensure that there is no flow through the sensor, then retry.
			Cycle power to the flowmeter, then retry.
A12	Excess calibration correction, zero too high	Zero too High	Ensure that there is no flow through the sensor, then retry.
			Cycle power to the flowmeter, then retry.
A13	Process too noisy to perform auto zero	Zero too Noisy	Remove or reduce sources of electromechanical noise, then attempt the calibration or zero procedure again. Sources of noise include: • Mechanical pumps • Pipe stress at sensor • Electrical interference • Vibration effects from nearby machinery
			Cycle power to the flowmeter, then retry. See Section 10.23.

Table 10-5 Status alarms and remedies (continued)

Alarm code	Communicator	ProLink II software	Possible remedy
A14	Electronics failure	Transmitter Fail	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A15	Data Loss Possible	Data Loss Possible	Cycle power to the flowmeter.
			Perform sensor coil and resistance tests. See Section 10.26.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A16	Line RTD Overrange	Line Temp Out-of-range	Check the test points. See Section 10.24.
			Check the sensor coils. See Section 10.26.
			Check wiring to sensor. See Section 10.13.2.
			Make sure the appropriate sensor type is configured. See Section 6.2.
			Contact Micro Motion. See Section 10.3.
A17	Meter RTD Overrange	Meter Temp Out-of-Range	Check the test points. See Section 10.24.
			Check the sensor coils. See Section 10.26.
			Contact Micro Motion. See Section 10.3.
A18	EEPROM Checksum—1000/2000	EEPROM Checksum	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A19	RAM Error—1000/2000	RAM Error	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A20	Calibration Factor Unentered (Flocal)	Cal Factor Unentered	Check the characterization. Specifically, verify the FCF value. See Section 6.2.
A21	Unrecognized/ Unentered Sensor Type (K1)	Incorrect Sensor Type	Check the characterization. Specifically, verify the K1 value. See Section 6.2.
A22	EEPROM Config Corrupt–Core Processor	Configuration Corrupt	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A23	EEPROM Totals Corrupt–Core Processor	Totals Corrupt	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A24	EEPROM Program Corrupt–Core Processor	CP Program Corrupt	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A25	Core Processor Boot Sector Fault	Boot Sector Fault	Cycle power to the flowmeter.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.

Table 10-5 Status alarms and remedies (continued)

Alarm code	Communicator	ProLink II software	Possible remedy
A26	Sensor/Xmtr Communication Error	Sensor/Transmitter Comm Failure	Check the wiring between the transmitter and the core processor (see Section 10.13.2). The wires may be swapped. After swapping wires, cycle power to the flowmeter.
			Check for noise in wiring or transmitter environment.
			Check the core processor LED. See Section 10.25.
			Check that the core processor is receiving power. See Section 10.13.1.
			Perform the core processor resistance test. See Section 10.25.2.
A27	Security Breach	Security Breach	Weights and Measures security seal has been broken. Alarm can be cleared by user, but authorized procedure is required to reestablish security. Contact Micro Motion.
A28	Xmtr Write Error	Core processor write failure	Cycle power to the flowmeter.
			The transmitter might need service or upgrading. Contact Micro Motion. See Section 10.3.
A100	Analog output 1 saturated	Analog 1 Saturated	See Section 10.17.
A101	Analog output 1 fixed	Analog 1 Fixed	Check the HART polling address. See Section 10.18.
			Exit mA output trim. See Section 5.4.
			Exit mA output loop test. See Section 5.3.
			Check to see if the output has been fixed via digital communication.
A102	Drive over range	Drive Overrange	Excessive drive gain. See Section 10.24.3.
			Check the sensor coils. See Section 10.26.
A103	Data loss possible	Data Loss Possible	Cycle power to the flowmeter.
			View the entire current configuration to determine what data were lost. Configure any settings with missing or incorrect data.
			The transmitter might need service. Contact Micro Motion. See Section 10.3.
A104	Calibration in progress	Calibration in Progress	Allow the flowmeter to complete calibration.
A105	Slug flow	Slug Flow	See Section 10.16.
A106	Burst mode enabled	Burst Mode	No action required.
A107	Power reset occurred	Power Reset	No action required.
A108	Event 1 triggered	Event 1 On	Be advised of alarm condition.
			If you believe the event has been triggered erroneously, verify the Event 1 settings. See Section 8.10.
A109	Event 2 triggered	Event 2 On	Be advised of alarm condition.
			If you believe the event has been triggered erroneously, verify the Event 2 settings. See Section 8.10.
A110	Frequency over range	Frequency Saturated	See Section 10.17.
A111	Freq output fixed	Frequency Output Fixed	Exit frequency output loop test.

Table 10-5 Status alarms and remedies (continued)

Alarm code	Communicator	ProLink II software	Possible remedy
A112	Series 1000/2000 software upgrade recommended	NA	Contact Micro Motion to get a Series 1000/2000 transmitter software upgrade. See Section 10.3. Note that the device is still functional.
A113	Analog output 2 saturated	Analog 2 Saturated	See Section 10.17.
A114	Analog output 2 fixed	Analog 2 Fixed	Exit mA output loop test. See Section 5.3.
			Exit mA output trim. See Section 5.4.
			Check to see if the output has been fixed via digital communication.
A115	External input error	External Input Error	HART polling connection to external device has failed. Ensure that external device is available: • Verify device operation. • Verify wiring.
			Verify polling configuration. See Section 9.4.
A116	API temperature out of limits	API temperature out of limits	Verify process.
			Verify API reference table and temperature configuration. See Section 8.5.
A117	API density out of limits	API density out of limits	Verify process.
			Verify API reference table and density configuration. See Section 8.5.
A118	Discrete output 1 fixed	DO1 Fixed	Exit discrete output loop test. See Section 5.3.
A119	Discrete output 2 fixed	DO2 Fixed	Exit discrete output loop test. See Section 5.3.
A120	Bad fit data fault.	Bad fit data fault	Verify enhanced density configuration.
A121	Extrapolation warning	Extrapolation warning	Verify process temperature.
			Verify process density.
			Verify enhanced density configuration.
NA	Density FD cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 1st point cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 2nd point cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 3rd point cal in progress	NA	Be advised that density calibration is in progress.
NA	Density 4th point cal in progress	NA	Be advised that density calibration is in progress.
NA	Mech. zero cal in progress	NA	Be advised that zero calibration is in progress.
NA	Flow is in reverse direction	NA	Be advised that the process is flowing in reverse direction.

10.12 Checking process variables

Micro Motion suggests that you make a record of the process variables listed below, under normal operating conditions. This will help you recognize when the process variables are unusually high or low.

- Flow rate
- Density
- Temperature
- Tube frequency
- Pickoff voltage
- Drive gain

For troubleshooting, check the process variables under both normal flow and tubes-full no-flow conditions. Except for flow rate, you should see little or no change between flow and no-flow conditions. If you see a significant difference, record the values and contact the Micro Motion Customer Service Department for assistance. See Section 10.3.

Unusual values for process variables may indicate a variety of different problems. Table 10-6 lists several possible problems and remedies.

Table 10-6 Process variables problems and possible remedies

Symptom	Cause	Possible remedy
Steady non-zero flow rate under no-flow conditions	Misaligned piping (especially in new installations)	Correct the piping.
	Open or leaking valve	Check or correct the valve mechanism.
	Bad sensor zero	Rezero the flowmeter. See Section 5.5.
	Bad flow calibration factor	Verify characterization. See Section 6.2.

Table 10-6 Process variables problems and possible remedies (continued)

Symptom	Cause	Possible remedy
Erratic non-zero flow rate under no-flow conditions	RF interference	Check environment for RF interference. See Section 10.13.4.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
	Incorrectly grounded 9-wire cable (in 9-wire remote installations and remote core processor with remote transmitter installations)	Verify 9-wire cable installation. Refer to Appendix B for diagrams, and see the installation manual for your transmitter.
	Vibration in pipeline at rate close to sensor tube frequency	Check environment and remove source of vibration.
	Leaking valve or seal	Check pipeline.
	Inappropriate measurement unit	Check configuration. See Section 10.19.
	Inappropriate damping value	Check configuration. See Section 6.5.5 and Section 8.7.
	Slug flow	See Section 10.16.
	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes.
	Moisture in sensor junction box	Open junction box and allow it to dry. Do not use contact cleaner. When closing, ensure integrity of gaskets and O-rings, and grease all O-rings.
	Mounting stress on sensor	Check sensor mounting. Ensure: • Sensor is not being used to support pipe. • Sensor is not being used to correct pipe misalignment. • Sensor is not too heavy for pipe.
	Sensor cross-talk	Check environment for sensor with similar (±0.5 Hz) tube frequency.
	Incorrect sensor orientation	Sensor orientation must be appropriate to process fluid. See the installation manual for your sensor.
Erratic non-zero flow rate when flow is steady	Output wiring problem	Verify wiring between transmitter and receiving device. See the installation manual for your transmitter.
	Problem with receiving device	Test with another receiving device.
	Inappropriate measurement unit	Check configuration. See Section 10.19.
	Inappropriate damping value	Check configuration. See Section 6.5.5 and Section 8.7.
	Excessive or erratic drive gain	See Section 10.24.3 and Section 10.24.4.
	Slug flow	See Section 10.16.
	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.

Table 10-6 Process variables problems and possible remedies (continued)

Symptom	Cause	Possible remedy
Inaccurate flow rate or batch total	Bad flow calibration factor	Verify characterization. See Section 6.2.
	Inappropriate measurement unit	Check configuration. See Section 10.19.
	Bad sensor zero	Rezero the flowmeter. See Section 5.5.
	Bad density calibration factors	Verify characterization. See Section 6.2.
	Bad flowmeter grounding	See Section 10.13.3.
	Slug flow	See Section 10.16.
	Problem with receiving device	See Section 10.15.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
Inaccurate density reading	Problem with process fluid	Use standard procedures to check quality of process fluid.
	Bad density calibration factors	Verify characterization. See Section 6.2.
	Wiring problem	Verify all sensor-to-transmitter wiring and ensure the wires are making good contact.
	Bad flowmeter grounding	See Section 10.13.3.
	Slug flow	See Section 10.16.
	Sensor cross-talk	Check environment for sensor with similar (±0.5 Hz) tube frequency.
	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes.
Temperature reading significantly different from process temperature	RTD failure	Check for alarm conditions and follow troubleshooting procedure for indicated alarm. Verify “Use external temperature” configuration and disable if appropriate. See Section 9.3.
Temperature reading slightly different from process temperature	Temperature calibration required	Perform temperature calibration. See Section C.4.
Unusually high density reading	Plugged flow tube	Check drive gain and tube frequency. Purge the flow tubes.
	Incorrect K2 value	Verify characterization. See Section 6.2.
Unusually low density reading	Slug flow	See Section 10.16.
	Incorrect K2 value	Verify characterization. See Section 6.2.
Unusually high tube frequency	Sensor erosion	Contact Micro Motion. See Section 10.3.
Unusually low tube frequency	Plugged flow tube	Purge the flow tubes.
Unusually low pickoff voltages	Several possible causes	See Section 10.24.5.
Unusually high drive gain	Several possible causes	See Section 10.24.3.

10.13 Diagnosing wiring problems

Use the procedures in this section to check the transmitter installation for wiring problems.

> **⚠ WARNING**
>
> **Removing the wiring compartment covers in explosive atmospheres while the power is on can subject the transmitter to environmental conditions that can cause an explosion.**
>
> Before removing the wiring compartment cover in explosive atmospheres, be sure to shut off the power and wait five minutes.

10.13.1 Checking the power supply wiring

To check the power supply wiring:

1. Verify that the correct external fuse is used. An incorrect fuse can limit current to the transmitter and keep it from initializing.
2. Power down the transmitter.
3. If the transmitter is in a hazardous area, wait five minutes.
4. Ensure that the power supply wires are connected to the correct terminals. Refer to Appendix B for diagrams.
5. Verify that the power supply wires are making good contact, and are not clamped to the wire insulation.
6. (Model 1700/2700 transmitters only) Inspect the voltage label on the inside of the field-wiring compartment. Verify that the voltage supplied to the transmitter matches the voltage specified on the label.
7. Use a voltmeter to test the voltage at the transmitter's power supply terminals. Verify that it is within the specified limits. For DC power, you may need to size the cable. Refer to Appendix B for diagrams, and see your transmitter installation manual for power supply requirements.

10.13.2 Checking the sensor-to-transmitter wiring

To check the sensor-to-transmitter wiring, verify that:

- The transmitter is connected to the sensor according to the wiring information provided in your transmitter installation manual. Refer to Appendix B for diagrams.
- The wires are making good contact with the terminals.

If the wires are incorrectly connected:

1. Power down the transmitter.
2. If the transmitter is in a hazardous area, wait five minutes.
3. Correct the wiring.
4. Restore power to the transmitter.

10.13.3 Checking grounding

The sensor and the transmitter must be grounded. If the core processor is installed as part of the transmitter or the sensor, it is grounded automatically. If the core processor is installed separately, it must be grounded separately. See your sensor and transmitter installation manuals for grounding requirements and instructions.

10.13.4 Checking for RF interference

If you are experiencing RF (radio frequency) interference on your frequency output or discrete output, use one of the following solutions:

- Eliminate the RF source. Possible causes include a source of radio communications, or a large transformer, pump, motor, or anything else that can generate a strong electrical or electromagnetic field, in the vicinity of the transmitter.
- Move the transmitter.
- Use shielded cable for the frequency output.
  - Terminate output cable shielding at the input device. If this is not possible, terminate the output shielding at the cable gland or conduit fitting.
  - Do not terminate shield inside the wiring compartment.
  - 360° termination of shielding is not necessary.

10.13.5 Checking the HART communication loop

To check the HART communication loop:

1. Verify that the loop wires are connected as shown in the wiring diagrams in the transmitter installation manual.
2. Remove analog loop wiring.
3. Install a 250 Ohm resistor across the primary mA terminals.
4. Check for voltage drop across the resistor (4–20 mA = 1–5 VDC). If voltage drop < 1 VDC, add resistance to achieve voltage drop > 1 VDC.
5. Connect the Communicator directly across the resistor and attempt to communicate (poll).

If your HART network is more complex than the wiring diagrams in the transmitter installation manual, either:

- Contact Micro Motion. See Section 10.3.
- Contact the HART Communication Foundation or refer to the *HART Application Guide*, available from the HART Communication Foundation on the Internet at www.hartcomm.org.

10.14 Checking the communication device

Ensure that your communication device is compatible with your transmitter.

Communicator

The 275 HART Communicator or 375 Field Communicator is required, and must contain the appropriate device description.

Note: For the Model 2500 transmitter, the 275 HART Communicator uses the device description for the Model 2700 transmitter with configurable input/outputs. See Chapter 4 for more information.

Note: The 268 SMART FAMILY Interface is not compatible with Series 1000/2000 transmitters.

To check the device descriptions:

1. Turn on the Communicator, but do not connect it to the transmitter.
2. When the words **No device found** appear, press **OK**.
3. Select **OFFLINE**.
4. Select **New Configuration**.
5. Select **Micro Motion**.
6. Ensure that the correct device description for your transmitter is listed. See Table 10-7.

If the correct device description is not found, a Generic Device menu is displayed.

- Model 1500/2500 transmitters: You must obtain a 375 Field Communicator. Contact Micro Motion customer support.
- Model 1700/2700 transmitters: The 275 HART Communicator must be upgraded. Contact Micro Motion customer support.

Table 10-7 HART Communicator 275 device descriptions

Transmitter	Device description
Model 1500	1500 Mass Flow
Model 2500 CIO	2000C Mass Flow
Model 1700 Analog	1000 Mass Flow
Model 1700 IS	1000I Mass Flow
Model 2700 Analog	2000 Mass Flow
Model 2700 IS	2000I Mass Flow
Model 2700 CIO	2000C Mass Flow

ProLink II

ProLink II v2.0 or later is required. The original version of ProLink is not compatible with the Series 1000/2000 transmitter.

To check the version of ProLink II:

1. Start ProLink II.
2. Open the **Help** menu.
3. Click on **About ProLink**.

AMS

Your AMS software must have Device Revisions 1 to 3. Contact Emerson Process Management.

10.15 Checking the output wiring and receiving device

If you receive an inaccurate frequency or mA reading, there may be a problem with the output wiring or the receiving device.

- Check the output level at the transmitter.
- Check the wiring between the transmitter and the receiving device.
- Try a different receiving device.

10.16 Checking slug flow

Slugs—gas in a liquid process or liquid in a gas process—occasionally appear in some applications. The presence of slugs can significantly affect the process density reading. Slug flow limits and duration can help the transmitter suppress extreme changes in reading.

Note: Default slug flow limits are 0.0 and 5.0 g/cm^3. Raising the low slug flow limit or lowering the high slug flow limit will increase the possibility of slug flow conditions.

If slug limits have been configured, and slug flow occurs:

- A slug flow alarm is generated.
- All outputs that are configured to represent flow rate hold their last "pre-slug flow" value for the configured slug flow duration.

If the slug flow condition clears before the slug-flow duration expires:

- Outputs that represent flow rate revert to reporting actual flow.
- The slug flow alarm is deactivated, but remains in the active alarm log until it is acknowledged.

If the slug flow condition does not clear before the slug-flow duration expires, outputs that represent flow rate report a flow rate of zero.

If slug time is configured for 0.0 seconds, outputs that represent flow rate will report zero flow as soon as slug flow is detected.

If slug flow occurs:

- Check process for cavitation, flashing, or leaks.
- Change the sensor orientation.
- Monitor density.
- If desired, enter new slug flow limits (see Section 8.11).
- If desired, increase slug duration (see Section 8.11).

10.17 Checking output saturation

If an output variable exceeds the upper range limit or goes below the lower range limit, the applications platform produces an output saturation alarm. The alarm can mean:

- The output variable is outside appropriate limits for the process.
- The unit of flow needs to be changed.
- Sensor flow tubes are not filled with process fluid.
- Sensor flow tubes are plugged.

If an output saturation alarm occurs:

- Bring flow rate within sensor limit.
- Check the measurement unit. You may be able to use a smaller or larger unit.
- Check the sensor:
  - Ensure that flow tubes are full.
  - Purge flow tubes.
- For the mA outputs, change the mA URV and LRV (see Section 6.5.2).
- For the frequency output, change the scaling (see Section 6.6).

10.18 Setting the HART polling address to zero

If the transmitter's HART polling address is set to a nonzero number, the primary mA output is fixed at 4 mA. In this situation:

- The primary mA output will not report process variable data.
- The primary mA output will not indicate fault conditions.

If the HART address is set to zero, the primary mA output will report the primary variable on a 4–20 mA scale.

See Section 8.15.2.

10.19 Checking the flow measurement unit

Using an incorrect flow measurement unit can cause the transmitter to produce unexpected output levels, with unpredictable effects on the process. Make sure that the configured flow measurement unit is correct. Check the abbreviations; for example, *g/min* represents grams per minute, not gallons per minute. See Section 6.4.

10.20 Checking the upper and lower range values

A saturated mA output or incorrect mA measurement could indicate a faulty URV or LRV. Verify that the URV and LRV are correct and change them if necessary. See Section 6.5.2.

10.21 Checking the frequency output scale and method

A saturated frequency output or an incorrect frequency measurement could indicate a faulty frequency output scale and/or method. Verify that the frequency output scale and method are correct and change them if necessary. See Section 6.6.

10.22 Checking the characterization

A transmitter that is incorrectly characterized for its sensor might produce inaccurate output values. If the flowmeter appears to be operating correctly but sends inaccurate output values, an incorrect characterization could be the cause.

If you discover that any of the characterization data are wrong, perform a complete characterization. See Section 6.2.

10.23 Checking the calibration

Improper calibration can cause the transmitter to send unexpected output values. If the transmitter appears to be operating correctly but sends inaccurate output values, an improper calibration may be the cause.

Micro Motion calibrates every transmitter at the factory. Therefore, you should suspect improper calibration only if the transmitter has been calibrated after it was shipped from the factory.

The calibration procedures in this manual are designed for calibration to a regulatory standard. See Appendix C. To calibrate for true accuracy, always use a measurement source that is more accurate than the flowmeter. Contact the Micro Motion Customer Service Department for assistance.

Note: Micro Motion recommends using meter factors, rather than calibration, to prove the meter against a regulatory standard or to correct measurement error. Contact Micro Motion before calibrating your flowmeter. For information on meter factors, see Section 8.13.

10.24 Checking the test points

Some status alarms that indicate a sensor failure or overrange condition can be caused by problems other than a failed sensor. You can diagnose sensor failure or overrange status alarms by checking the flowmeter test points. The *test points* include left and right pickoff voltages, drive gain, and tube frequency. These values describe the current operation of the sensor.

10.24.1 Obtaining the test points

You can obtain the test points with a Communicator or ProLink II software.

With a Communicator

To obtain the test points with a Communicator:

1. Select **Diag/Service**.
2. Select **Test Points**.
3. Select **Drive**.
   a. Write down the drive gain.
   b. Press **EXIT**.
4. Select **LPO**.
   a. Write down the left pickoff voltage.
   b. Press **EXIT**.
5. Select **RPO**.
   a. Write down the right pickoff voltage.
   b. Press **EXIT**.
6. Select **Tube**.
   a. Write down the tube frequency.
   b. Press **EXIT**.

With ProLink II software

To obtain the test points with ProLink II software:

1. Select **Diagnostic Information** from the **ProLink** menu.
2. Write down the values you find in the **Tube Frequency** box, the **Left Pickoff** box, the **Right Pickoff** box, and the **Drive Gain** box.

10.24.2 Evaluating the test points

Use the following guidelines to evaluate the test points:

- If the drive gain is unstable, refer to Section 10.24.3.
- If the value for the left or right pickoff does not equal the appropriate value from Table 10-8, based on the sensor flow tube frequency, refer to Section 10.24.5.
- If the values for the left and right pickoffs equal the appropriate values from Table 10-8, based on the sensor flow tube frequency, record your troubleshooting data and contact the Micro Motion Customer Service Department for assistance. See Section 10.3.

Table 10-8 Sensor pickoff values

Sensor[1]	Pickoff value
ELITE Model CMF sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model D, DL, and DT sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model F025, F050, F100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model F200 sensors (compact case)	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
Model F200 sensors (standard case)	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model H025, H050, H100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model H200 sensors	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
Model R025, R050, or R100 sensors	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency
Model R200 sensors	2.0 mV peak-to-peak per Hz based on sensor flow tube frequency
Micro Motion T-Series sensors	0.5 mV peak-to-peak per Hz based on sensor flow tube frequency
CMF400 I.S. sensors	2.7 mV peak-to-peak per Hz based on sensor flow tube frequency
CMF400 sensors with booster amplifiers	3.4 mV peak-to-peak per Hz based on sensor flow tube frequency

(1) If your sensor is not listed, contact Micro Motion. See Section 10.3.

10.24.3 Excessive drive gain

Excessive drive gain can be caused by several problems. See Table 10-9.

Table 10-9 Excessive drive gain causes and remedies

Cause	Possible remedy
Excessive slug flow	See Section 10.16.
Plugged flow tube	Purge the flow tubes.
Cavitation or flashing	Increase inlet or back pressure at the sensor.
	If a pump is located upstream from the sensor, increase the distance between the pump and sensor.
Drive board or module failure, cracked flow tube, or sensor imbalance	Contact Micro Motion. See Section 10.3.
Mechanical binding at sensor	Ensure sensor is free to vibrate.
Open drive or left pickoff sensor coil	Contact Micro Motion. See Section 10.3.
Flow rate out of range	Ensure that flow rate is within sensor limits.
Incorrect sensor characterization	Verify characterization. See Section 6.2.

10.24.4 Erratic drive gain

Erratic drive gain can be caused by several problems. See Table 10-10.

Table 10-10 Erratic drive gain causes and remedies

Cause	Possible remedy
Wrong K1 characterization constant for sensor	Re-enter the K1 characterization constant. See Section 6.2.
Polarity of pick-off reversed or polarity of drive reversed	Contact Micro Motion. See Section 10.3.
Slug flow	See Section 10.16.
Foreign material caught in flow tubes	Purge flow tubes.

10.24.5 Low pickoff voltage

Low pickoff voltage can be caused by several problems. See Table 10-11.

Table 10-11 Low pickoff voltage causes and remedies

Cause	Possible remedy
Faulty wiring runs between the sensor and core processor	Verify wiring. Refer to Appendix B for diagrams, and see your transmitter installation manual.
Process flow rate beyond the limits of the sensor	Verify that the process flow rate is not out of range of the sensor.
Slug flow	See Section 10.16.
No tube vibration in sensor	Check for plugging.
	Ensure sensor is free to vibrate (no mechanical binding).
	Verify wiring.
	Test coils at sensor. See Section 10.26.
Moisture in the sensor electronics	Eliminate the moisture in the sensor electronics.
The sensor is damaged	Contact Micro Motion.

10.25 Checking the core processor

Two core processor procedures are available:

- You can check the core processor LED. The core processor has an LED that indicates different flowmeter conditions. See Table 10-12.
- You can perform the core processor resistance test to check for a damaged core processor.

10.25.1 Checking the core processor LED

To check the core processor LED:

1. Determine your installation type. See Section 1.3 and refer to Appendix B for diagrams.
2. Maintain power to the transmitter.
3. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation:
   a. Remove the core processor lid (for Model 1500/2500 transmitters, see Figure B-2; for Model 1700/2700 transmitters, see Figure B-11). The core processor is instrinsically safe and can be opened in all environments.
   b. Check the core processor LED against the conditions described in Table 10-12.
   c. To return to normal operation, replace the lid.

4. If you have an integral installation (Model 1700/2700 transmitters only):
   a. Loosen the four cap screws that fasten the transmitter to the base (see Figure B-8).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the cap screws. Do not disconnect or damage the wires that connect the transmitter to the core processor.
   d. Check the core processor LED against the conditions described in Table 10-12.
   e. To return to normal operation:
      - Gently lower the transmitter onto the base, inserting the cap screws into the slots. Do not pinch or stress the wires.
      - Rotate the transmitter clockwise so that the cap screws are in the locked position.
      - Tighten the cap screws, torquing to 20 to 30 in-lbs (2,3 to 3,4 N-m).
5. If you have a 9-wire remote installation (Model 1700/2700 transmitters only):
   a. Remove the end-cap (see Figure B-10).
   b. Inside the core processor housing, loosen the three screws that hold the core processor mounting plate in place. Do not remove the screws. Rotate the mounting plate so that the screws are in the unlocked position.
   c. Holding the tab on the mounting plate, slowly lower the mounting plate so that the top of the core processor is visible. Do not disconnect or damage the wires that connect the core processor to the transmitter.
   d. Check the core processor LED against the conditions described in Table 10-12.
   e. To return to normal operation:
      - Gently slide the mounting plate into place. Do not pinch or stress the wires.
      - Rotate the mounting plate so that the screws are in the locked position.
      - Tighten the screws, torquing to 6 to 8 in-lbs (0,7 to 0,9 N-m).
      - Replace the end-cap.

Note: When reassembling the flowmeter components, be sure to grease all O-rings.

Table 10-12 Core processor LED behavior, flowmeter conditions, and remedies

LED behavior	Condition	Possible remedy
1 flash per second (ON 25%, OFF 75%)	Normal operation	No action required.
1 flash per second (ON 75%, OFF 25%)	Slug flow	See Section 10.16.
Solid ON	Zero or calibration in progress	If calibration is in progress, no action required. If no calibration is in progress, contact Micro Motion. See Section 10.3.
	Core processor receiving between 11.5 and 5 volts	Check power supply to transmitter. See Section 10.13.1, and refer to Appendix B for diagrams.

Table 10-12 Core processor LED behavior, flowmeter conditions, and remedies (continued)

LED behavior	Condition	Possible remedy
3 rapid flashes, followed by pause	Sensor not recognized	Check wiring between transmitter and sensor (9-wire remote installation or remote core processor with remote transmitter installation). Refer to Appendix B for diagrams, and see your transmitter installation manual.
	Improper configuration	Check sensor characterization parameters. See Section 6.2.
	Broken pin between sensor and core processor	Contact Micro Motion. See Section 10.3.
4 flashes per second	Fault condition	Check alarm status.
OFF	Core processor receiving less than 5 volts	• Verify power supply wiring to core processor. Refer to Appendix B for diagrams. • If transmitter status LED is lit, transmitter is receiving power. Check voltage across terminals 1 (VDC+) and 2 (VDC–) in core processor. Normal reading is approximately 14 VDC. If reading is normal, internal core processor failure is possible. Contact Micro Motion. See Section 10.3. If reading is 0, internal transmitter failure is possible. Contact Micro Motion. See Section 10.3. If reading is less than 1 VDC, verify power supply wiring to core processor. Wires may be switched. See Section 10.13.1, and refer to Appendix B for diagrams. • If transmitter status LED is not lit, transmitter is not receiving power. Check power supply. See Section 10.13.1, and refer to Appendix B for diagrams. If power supply is operational, internal transmitter, display, or LED failure is possible. Contact Micro Motion. See Section 10.3.
	Core processor internal failure	Contact Micro Motion. See Section 10.3.

10.25.2 Core processor resistance test

To perform the core processor resistance test:

1. Determine your installation type. See Section 1.3 and refer to Appendix B for diagrams.
2. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation, remove the core processor lid (for Model 1500/2500 transmitters, see Figure B-2; for Model 1700/2700 transmitters, see Figure B-11).
3. If you have an integral installation (Model 1700/2700 transmitters only):
   a. Loosen the four cap screws that fasten the transmitter to the base (see Figure B-8).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the cap screws.
4. If you have a 9-wire remote installation (Model 1700/2700 transmitters only):
   a. Remove the end-cap (see Figure B-10).
   b. Inside the core processor housing, loosen the three screws that hold the core processor mounting plate in place. Do not remove the screws. Rotate the mounting plate so that the screws are in the unlocked position.
   c. Holding the tab on the mounting plate, slowly lower the mounting plate so that the top of the core processor is visible.
5. Disconnect the 4-wire cable between the core processor and the transmitter.

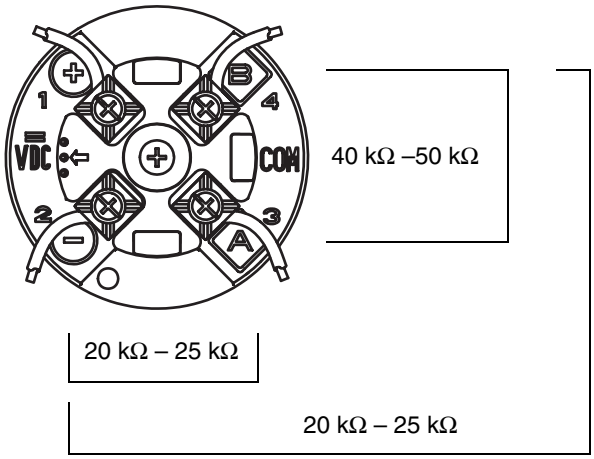
6. Measure the resistance between core processor terminals 3 and 4 (RS-485A and RS-485B). See Figure 10-1. Resistance should be 40 kΩ to 50 kΩ.
7. Measure the resistance between core processor terminals 2 and 3 (VDC– and RS-485A). Resistance should be 20 kΩ to 25 kΩ.
8. Measure the resistance between core processor terminals 2 and 4 (VDC– and RS-485B). Resistance should be 20 kΩ to 25 kΩ.
9. If any resistance measurements are lower than specified, the core processor may not be able to communicate with a transmitter or a remote host. Contact Micro Motion (see Section 10.3).

To return to normal operation:

1. Reconnect the 4-wire cable between the core processor and the transmitter (for Model 1500/2500 transmitters, see Figure B-3; for Model 1700/2700 transmitters, see Figure B-12).
2. If you have a 4-wire remote installation or a remote core processor with remote transmitter installation, replace the core processor lid.
3. If you have an integral installation:
   a. Gently lower the transmitter onto the base, inserting the cap screws into the slots. Do not pinch or stress the wires.
   b. Rotate the transmitter clockwise so that the cap screws are in the locked position.
   c. Tighten the cap screws, torquing to 20 to 30 in-lbs (2,3 to 3,4 N-m).
4. If you have a 9-wire remote installation:
   a. Gently slide the mounting plate into place. Do not pinch or stress the wires.
   b. Rotate the mounting plate so that the screws are in the locked position.
   c. Tighten the screws, torquing to 6 to 8 in-lbs (0,7 to 0,9 N-m).
   d. Replace the end-cap.

Note: When reassembling the flowmeter components, be sure to grease all O-rings.

Figure 10-1 Core processor resistance test



10.26 Checking sensor coils and RTD

Problems with sensor coils can cause several alarms, including sensor failure and a variety of out-of-range conditions. Testing the sensor coils involves testing the terminal pairs and testing for shorts to case.

10.26.1 9-wire remote or remote core processor with remote transmitter installation

If you have a 9-wire remote installation or a remote core processor with remote transmitter (see Section 1.3 and refer to Appendix B for diagrams):

1. Power down the transmitter.
2. If the transmitter is in a hazardous area, wait five minutes.
3. Remove the end-cap from the core processor housing.
4. Unplug the terminal blocks from the terminal board.
5. Using a digital multimeter (DMM), check the pickoff coils listed in Table 10-13 by placing the DMM leads on the unplugged terminal blocks for each terminal pair. Record the values.

Table 10-13 Coils and test terminal pairs

	Test terminal pair	
Coil	**Colors**	**Numbers**
Drive coil	Brown to red	3 — 4
Left pickoff coil (LPO)	Green to white	5 — 6
Right pickoff coil (RPO)	Blue to gray	7 — 8
Resistance temperature detector (RTD)	Yellow to violet	1 — 2
Lead length compensator (LLC) (all sensors except CMF400 I.S. and T-Series) Composite RTD (T-Series sensors only) Fixed resistor (CMF400 I.S. sensors only)	Yellow to orange	1 — 9

6. There should be no open circuits, i.e., no infinite resistance readings. The LPO and RPO readings should be the same or very close (± 5 ohms). If there are any unusual readings, repeat the coil resistance tests at the sensor junction box to eliminate the possibility of faulty cable. The readings for each coil pair should match at both ends.
7. Leave the core processor terminal blocks disconnected. At the sensor, remove the lid of the junction box and test each sensor terminal for a short to case by placing one DMM lead on the terminal and the other lead on the sensor case. With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case.

8. Test terminal pairs as follows:
   a. Brown against all other terminals except Red
   b. Red against all other terminals except Brown
   c. Green against all other terminals except White
   d. White against all other terminals except Green
   e. Blue against all other terminals except Gray
   f. Gray against all other terminals except Blue
   g. Orange against all other terminals except Yellow and Violet
   h. Yellow against all other terminals except Orange and Violet
   i. Violet against all other terminals except Yellow and Orange

Note: D600 sensors and CMF400 sensors with booster amplifiers have different terminal pairs. Contact Micro Motion for assistance (see Section 10.3).

   There should be infinite resistance for each pair. If there is any resistance at all, there is a short between terminals.

9. See Table 10-14 for possible causes and solutions.
10. If the problem is not resolved, contact Micro Motion (see Section 10.3).
11. To return to normal operation:
    a. Plug the terminal blocks into the terminal board.
    b. Replace the end-cap on the core processor housing.
    c. Replace the lid on the sensor junction box.

Note: When reassembling the flowmeter components, be sure to grease all O-rings.

Table 10-14 Sensor and cable short to case possible causes and remedies

Possible cause	Solution
Moisture inside the sensor junction box	Make sure that the junction box is dry and no corrosion is present.
Liquid or moisture inside the sensor case	Contact Micro Motion. See Section 10.3.
Internally shorted feedthrough (sealed passage for wiring from sensor to sensor junction box)	Contact Micro Motion. See Section 10.3.
Faulty cable	Replace cable.
Improper wire termination	Verify wire terminations inside sensor junction box. See Micro Motion's *9-Wire Flowmeter Cable Preparation and Installation Guide* or the sensor documentation.

10.26.2 4-wire remote or integral installation

If you have a 4-wire remote installation or an integral installation (see Section 1.3 and refer to Appendix B for diagrams):

1. Power down the transmitter.
2. If the transmitter is in a hazardous environment, wait five minutes.
3. If you have a 4-wire remote installation, remove the core processor lid.

4. If you have an integral installation (Model 1700/2700 transmitters only):
   a. Loosen the four cap screws that fasten the transmitter to the base (see Figure B-8).
   b. Rotate the transmitter counter-clockwise so that the cap screws are in the unlocked position.
   c. Gently lift the transmitter straight up, disengaging it from the base.

Note: You may disconnect the 4-wire cable between the core processor and the transmitter, or leave it connected.

5. Loosen the captive screw (2.5 mm) in the center of the core processor. Carefully remove the core processor from the sensor by grasping it and lifting it straight up. **Do not twist or rotate the core processor**.

⚠ CAUTION

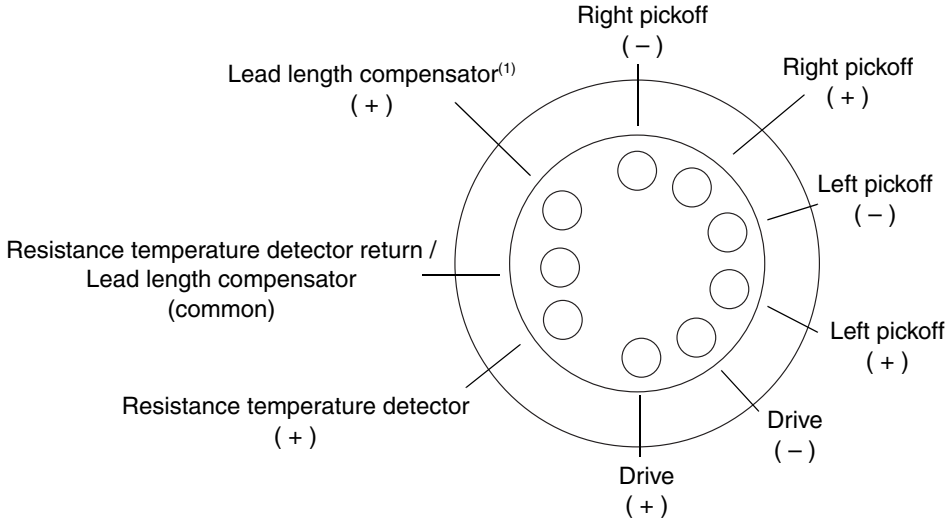
If the core processor pins are bent, broken, or damaged in any way, the core processor will not operate.

To avoid damage to the core processor pins:

- Do not twist or rotate the core processor when lifting it.
- When replacing the core processor on the pins, be sure to align the guide pins and mount the core processor carefully.

6. Using a digital multimeter (DMM), check the pickoff coil resistances by placing the DMM leads on the pin pairs. Refer to Figure 10-2 to identify the pins and pin pairs. Record the values.

Figure 10-2 Sensor pins



(1) LLC for all sensors except T-Series and CMF400 I.S. For T-Series sensors, functions as composite RTD. For CMF400 I.S. sensors, functions as fixed resistor.

7. There should be no open circuits, i.e., no infinite resistance readings. The LPO and RPO readings should be the same or very close (± 5 ohms).
8. Using the DMM, check between each pin and the sensor case. With the DMM set to its highest range, there should be infinite resistance on each lead. If there is any resistance at all, there is a short to case. See Table 10-14 for possible causes and solutions.
9. Test terminal pairs as follows:
   a. Drive + against all other terminals except Drive –
   b. Drive – against all other terminals except Drive +
   c. Left pickoff + against all other terminals except Left pickoff –
   d. Left pickoff – against all other terminals except Left pickoff +
   e. Right pickoff + against all other terminals except Right pickoff –
   f. Right pickoff – against all other terminals except Right pickoff +
   g. RTD + against all other terminals except LLC + and RTD/LLC
   h. LLC + against all other terminals except RTD + and RTD/LLC
   i. RTD/LLC against all other terminals except LLC + and RTD +

Note: D600 sensors and CMF400 sensors with booster amplifiers have different terminal pairs. Contact Micro Motion for assistance (see Section 10.3).

   There should be infinite resistance for each pair. If there is any resistance at all, there is a short between terminals. See Table 10-14 for possible causes and solutions.

10. If the problem is not resolved, contact Micro Motion (see Section 10.3).

To return to normal operation:

1. Align the three guide pins on the bottom of the core processor with the corresponding holes in the base of the core processor housing.
2. Carefully mount the core processor on the pins, taking care not to bend any pins.
3. Tighten the captive screw to 6 to 8 in-lbs (0,7 to 0,9 N-m) of torque.
4. If you have a 4-wire remote installation, replace the core processor lid.
5. If you have an integral installation:
   a. Gently lower the transmitter onto the base, inserting the cap screws into the slots. Do not pinch or stress the wires.
   b. Rotate the transmitter clockwise so that the cap screws are in the locked position.
   c. Tighten the cap screws, torquing to 20 to 30 in-lbs (2,3 to 3,4 N-m).

Note: When reassembling the flowmeter components, be sure to grease all O-rings.

Appendix A
Default Values and Ranges

A.1 Overview

This appendix provides information on the default values for most transmitter parameters. Where appropriate, valid ranges are also defined.

These default values represent the transmitter configuration after a master reset. Depending on how the transmitter was ordered, certain values may have been configured at the factory.

The default values listed here apply to all Version 4.x transmitters using a Version 2.x core processor.

A.2 Most frequently used defaults and ranges

The table below contains the default values and ranges for the most frequently used transmitter settings.

Table A-1 Transmitter default values and ranges

Type	Setting	Default	Range	Comments
Flow	Flow direction	Forward		
	Flow damping	0.8 sec	0.0 – 51.2 sec	User-entered value is corrected to nearest lower value in list of preset values. For gas applications, Micro Motion recommends a value of 3.2.
	Flow calibration factor	1.00005.13		For T-Series sensors, this value represents the FCF and FT factors concatenated. See Section 6.2.2.
	Mass flow units	g/s		
	Mass flow cutoff	0.0 g/s		Recommended setting is 0.5–1.0% of the sensor's rated maximum flowrate.
	Volume flow units	L/s		
	Volume flow cutoff	0/0 L/s	0.0 – *x* L/s	*x* is obtained by multiplying the flow calibration factor by 0.2, using units of L/s.
Meter factors	Mass factor	1.00000		
	Density factor	1.00000		
	Volume factor	1.00000		

Table A-1 Transmitter default values and ranges (continued)

Type	Setting	Default	Range	Comments
Density	Density damping	1.6 sec	0.0 – 51.2 sec	User-entered value is corrected to nearest value in list of preset values.
	Density units	g/cm^3		
	Density cutoff	0.2 g/cm^3	0.0 – 0.5 g/cm^3	
	D1	0.00000		
	D2	1.00000		
	K1	1000.00		
	K2	50,000.00		
	FD	0.00000		
	Temp Coefficient	4.44		
Slug flow	Slug flow low limit	0.0 g/cm^3	0.0 – 10.0 g/cm^3	
	Slug flow high limit	5.0 g/cm^3	0.0 – 10.0 g/cm^3	
	Slug duration	0.0 sec	0.0 – 60.0 sec	
Temperature	Temperature damping	4.8 sec	0.0 – 38.4 sec	User-entered value is corrected to nearest lower value in list of preset values.
	Temperature units	Deg C		
	Temperature calibration factor	1.00000T0.0000		
Pressure	Pressure units	PSI		
	Flow factor	0.00000		
	Density factor	0.00000		
	Cal pressure	0.00000		
T-Series sensor	D3	0.00000		
	D4	0.00000		
	K3	0.00000		
	K4	0.00000		
	FTG	0.00000		
	FFQ	0.00000		
	DTG	0.00000		
	DFQ1	0.00000		
	DFQ2	0.00000		
Special units	Base mass unit	g		
	Base mass time	sec		
	Mass flow conversion factor	1.00000		
	Base volume unit	L		
	Base volume time	sec		
	Volume flow conversion factor	1.00000		
Event 1	Variable	Density		
	Type	Low alarm		
	Setpoint	0.0		
	Setpoint units	g/cm^3		

Table A-1 Transmitter default values and ranges (continued)

Type	Setting	Default	Range	Comments
Event 2	Variable	Density		
	Type	Low alarm		
	Setpoint	0.0		
	Setpoint units	g/cm^3		
Variable mapping	Primary variable	Mass flow		
	Secondary variable	• Series 1000: Mass flow • Series 2000: Density		
	Tertiary variable	Mass flow		
	Quaternary variable	• Series 1000: Mass flow • Series 2000: Volume flow		
Update Rate	Update rate	Normal	Normal or Special	Normal = 20 Hz Special = 100 Hz
Primary mA output	Primary variable	Mass flow		
	LRV	–200.00000 g/s		
	URV	200.00000 g/s		
	AO cutoff	0.00000 g/s		
	AO added damping	0.00000 sec		
	LSL	–200 g/s		Read-only
	USL	200 g/s		Read-only
	MinSpan	0.3 g/s		Read-only
	Fault action	Downscale		
	AO fault level – downscale	2.0 mA	1.0 – 3.6 mA	
	AO fault level – upscale	22 mA	21.0 – 24.0 mA	
	Last measured value timeout	0.00 sec		
Secondary mA output	Secondary variable	Density		
	LRV	0.00000 g/cm^3		
	URV	10.00000 g/cm^3		
	AO cutoff	Not-A-Number		
	AO added damping	0.00000 sec		
	LSL	0.00 g/cm^3		Read-only
	USL	10.00 g/cm^3		Read-only
	MinSpan	0.05 g/cm^3		Read-only
	Fault action	Downscale		
	AO fault level – downscale	2.0 mA	1.0 – 3.6 mA	
	AO fault level – upscale	22 mA	21.0 – 24.0 mA	

Table A-1 Transmitter default values and ranges (continued)

Type	Setting	Default	Range	Comments
Frequency output	Tertiary variable	Mass flow		
	Frequency factor	1,000.00 Hz	.00091 – 10,000.00 Hz	
	Rate factor	16,666.66992 g/s		
	Frequency pulse width	277 mSec	0 – 277 mSec	
	Scaling method	Freq=Flow		
	Frequency fault action	Downscale		
	Frequency fault level – upscale	15,000 Hz	10.0 – 15,000 Hz	
	Frequency output polarity	Active high		
	Frequency output mode	Single		Default and not configurable if only one channel is configured for frequency
		Quadrature		If both Channel B and Channel C are configured for frequency
	Last measured value timeout	0.0 sec	0.0 – 60.0 sec	
Display	Variable 1	Mass flow rate		
	Variable 2	Mass totalizer		
	Variable 3	Volume flow rate		
	Variable 4	Volume totalizer		
	Variable 5	Density		
	Variable 6	Temperature		
	Variable 7–15	None		
	Display totalizer reset	Disabled		
	Display auto scroll	Disabled		
	Display offline menu	Enabled		
	Display offline password	Disabled		
	Display alarm menu	Enabled		
	Display acknowledge all alarms	Enabled		
	Offline password	1234		
	Auto scroll rate	10 sec		
	Display totalizer start/stop	Disabled		

Appendix B
Flowmeter Installation Types and Components

B.1 Overview

This appendix provides illustrations of different flowmeter installations and components, for:

- Model 1500/2500 transmitters
- Model 1700/2700 transmitters

B.2 Model 1500/2500 transmitters

B.2.1 Installation diagrams

Model 1500/2500 transmitters can be installed in two different ways:

- 4-wire remote
- Remote core processor with remote transmitter

See Figure B-1.

B.2.2 Component diagrams

In remote core processor with remote transmitter installations, the core processor is installed stand-alone. See Figure B-2.

B.2.3 Wiring and terminal diagrams

A 4-wire cable is used to connect the core processor to the transmitter. See Figure B-3.

Figure B-4 shows the transmitter's power supply terminals.

Figure B-5 shows the output terminals for the Model 1500 transmitter.

Figure B-6 shows the output terminals for the Model 2500 transmitter.

Figure B-1 Installation types – Model 1500/2500 transmitters

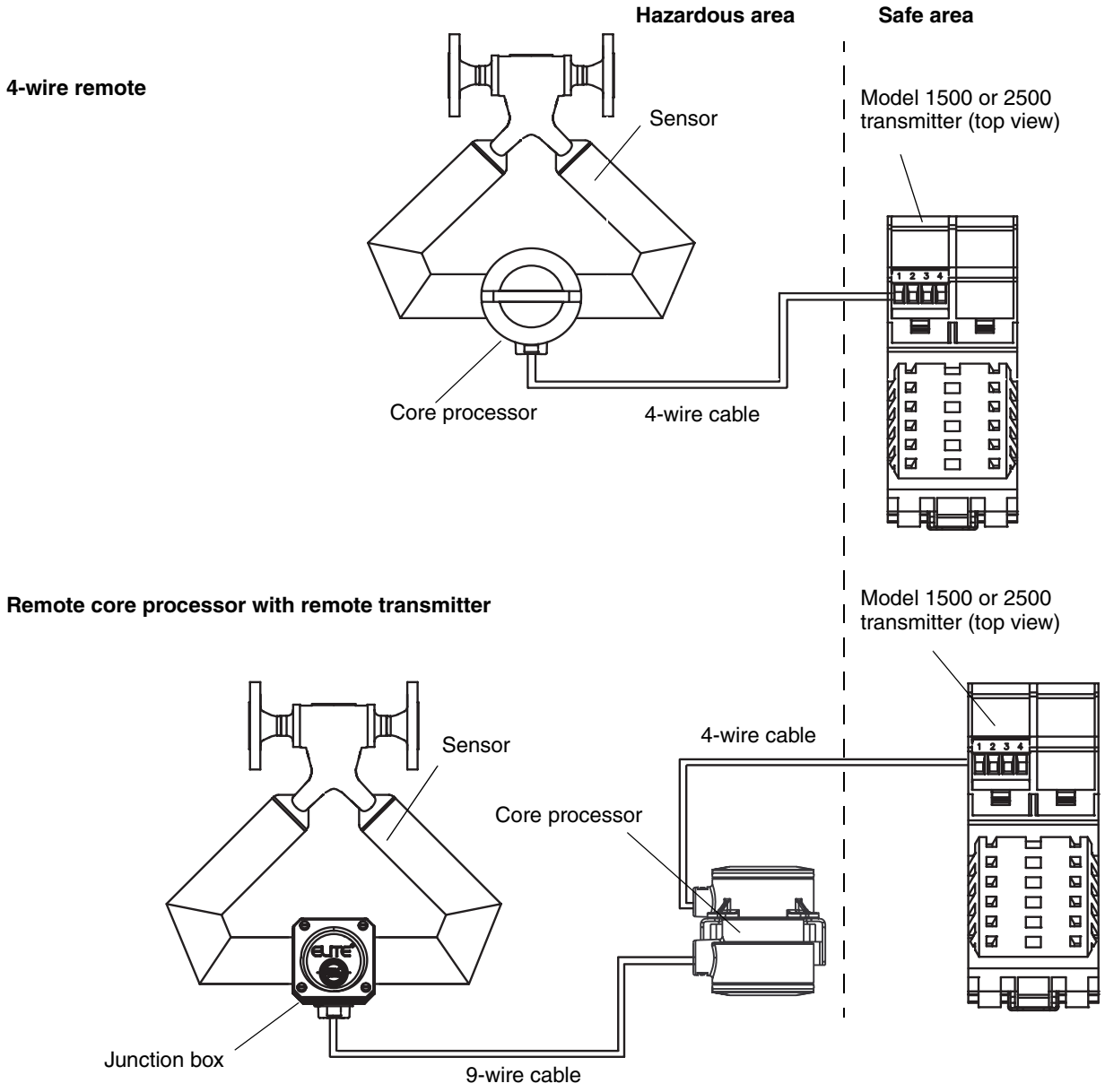


Figure B-2 Remote core processor components

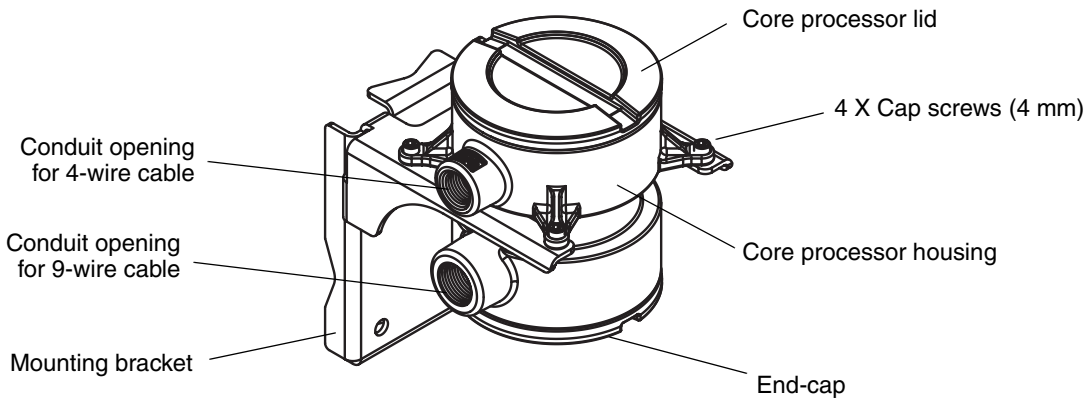


Figure B-3 4-wire cable between core processor and Model 1500/2500 transmitter

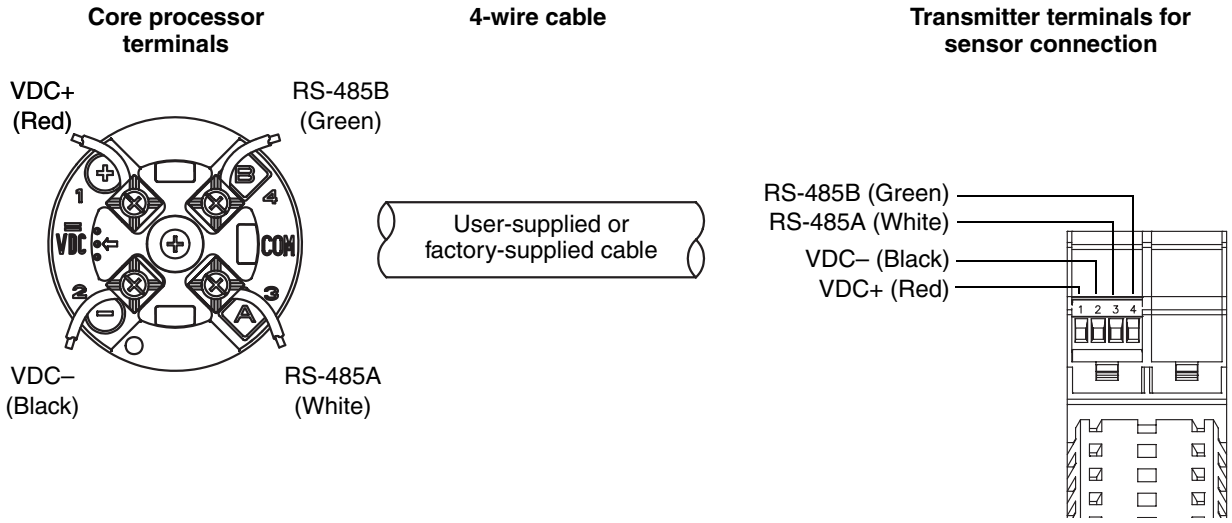


Figure B-4 Power supply terminals – Model 1500/2500

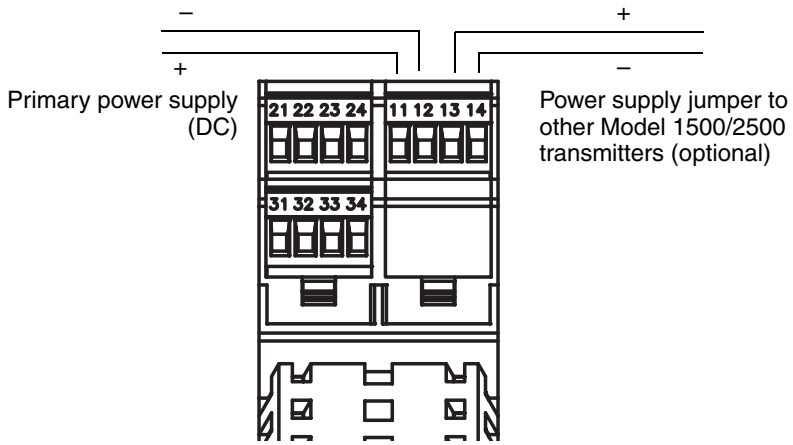


Figure B-5 Terminal configuration – Model 1500

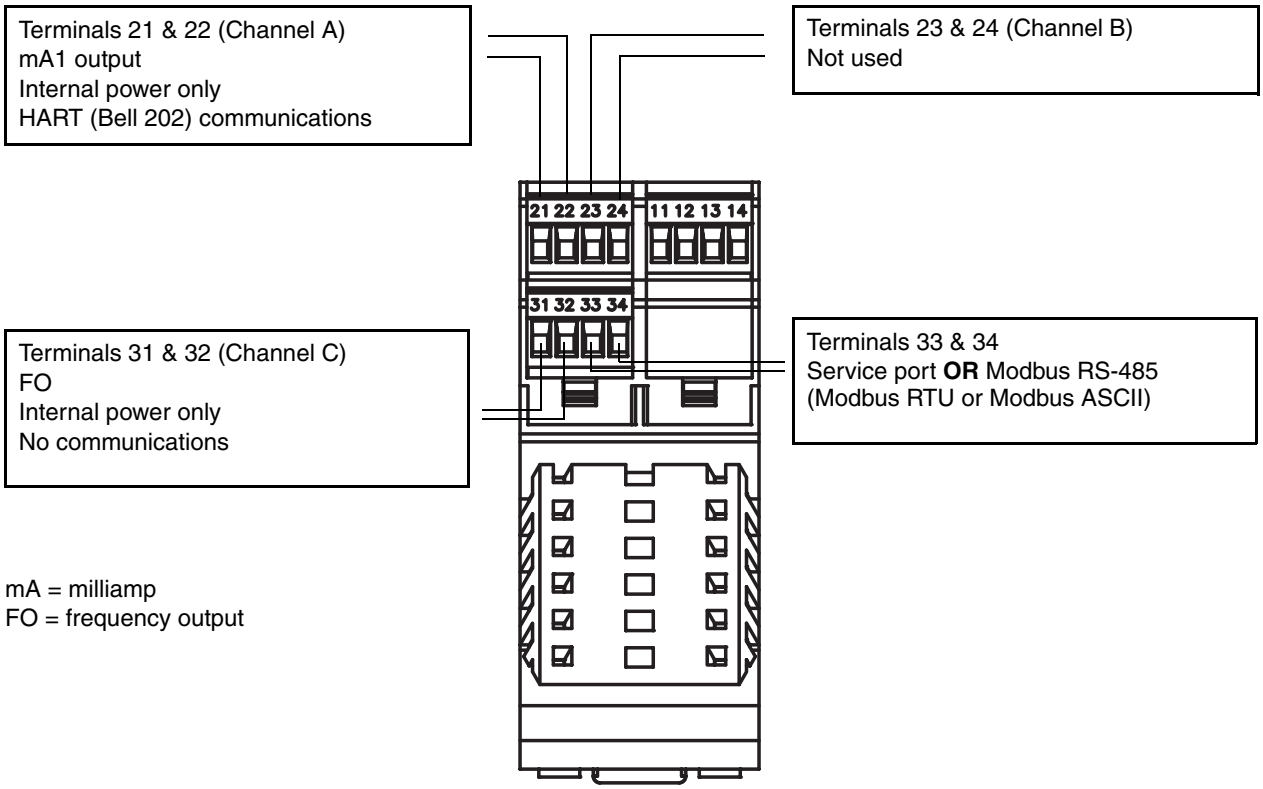
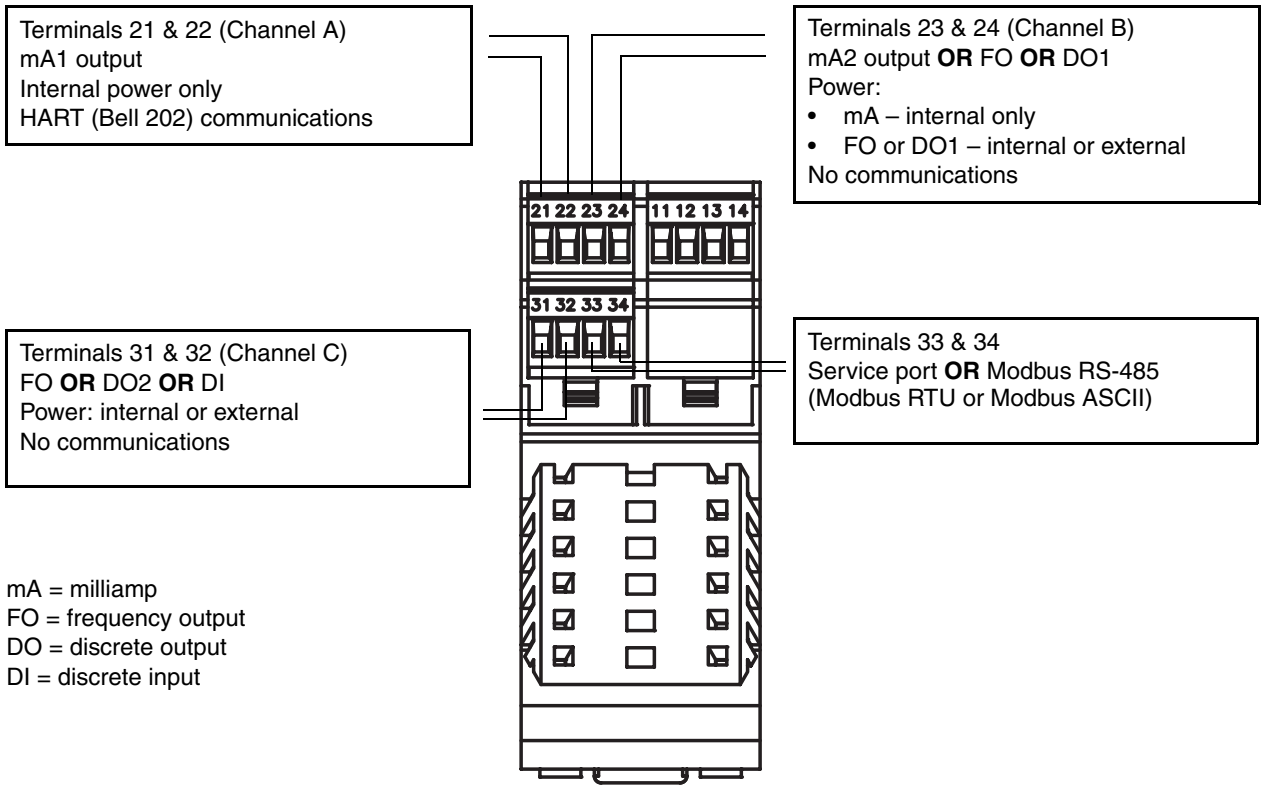


Figure B-6 Terminal configuration – Model 2500


Terminals 21 & 22 (Channel A)
mA1 output
Internal power only
HART (Bell 202) communications
Terminals 23 & 24 (Channel B)
mA2 output OR FO OR DO1
Power:
• mA – internal only
• FO or DO1 – internal or external
No communications
21 22 23 24
11 12 13 14
31 32 33 34
Terminals 31 & 32 (Channel C)
FO OR DO2 OR DI
Power: internal or external
No communications
Terminals 33 & 34
Service port OR Modbus RS-485
(Modbus RTU or Modbus ASCII)
mA = milliamp
FO = frequency output
DO = discrete output
DI = discrete input

B.3 Model 1700/2700 transmitters

B.3.1 Installation diagrams

Model 1700/2700 transmitters can be installed in four different ways:

- Integral
- 4-wire remote
- 9-wire remote
- Remote core processor with remote transmitter

See Figure B-7.

B.3.2 Component diagrams

Figure B-8 shows the transmitter and core processor components in integral installations.

Figure B-9 shows the transmitter components in 4-wire remote installations and remote core processor with remote transmitter installations.

Figure B-10 shows the transmitter/core processor assembly in 9-wire remote installations.

In remote core processor with remote transmitter installations, the core processor is installed stand-alone. See Figure B-11.

B.3.3 Wiring and terminal diagrams

In 4-wire remote and remote core processor with remote transmitter installations, a 4-wire cable is used to connect the core processor to the transmitter's mating connector. See Figure B-12.

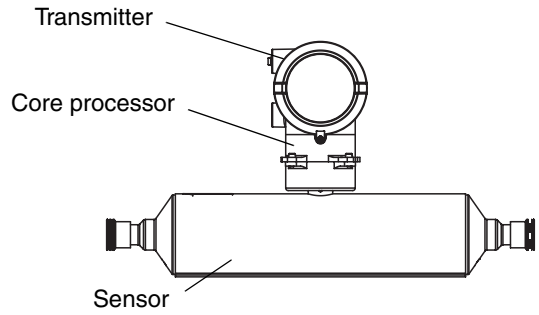
In 9-wire remote installations, a 9-wire cable is used to connect the junction box on the sensor to the terminals on the transmitter/core processor assembly. See Figure B-13

Figure B-14 shows the transmitter's power supply terminals.

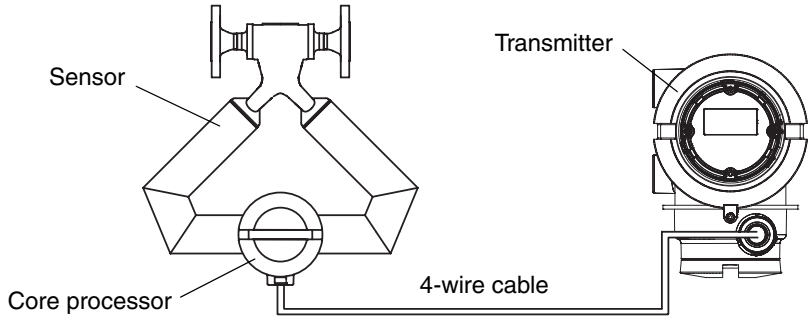
Figure B-15 shows the output terminals for the Model 1700/2700 transmitter.

Figure B-7 Installation types – Model 1700/2700 transmitters

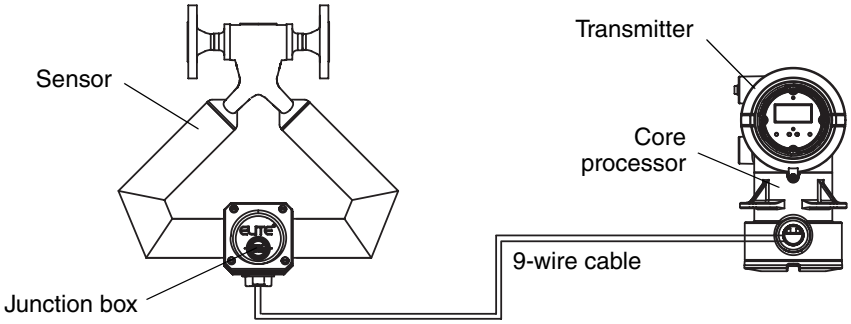
Integral



4-wire remote



9-wire remote



Remote core processor with remote transmitter

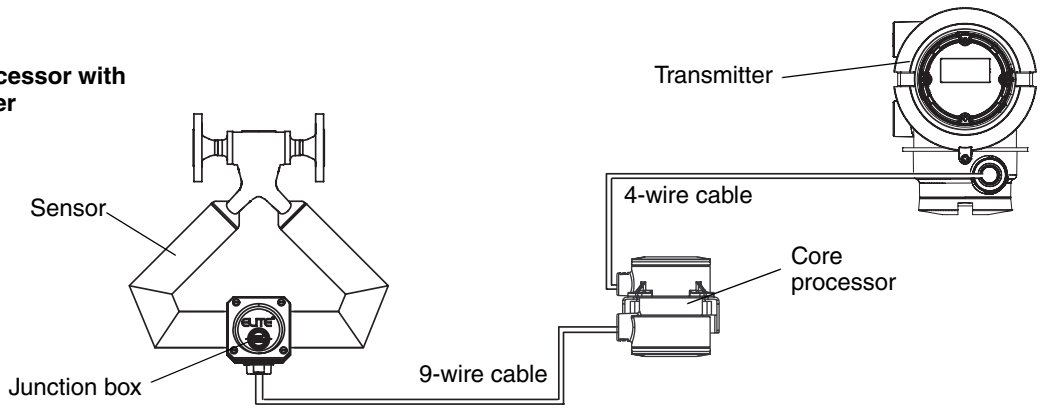


Figure B-8 Transmitter and core processor components – Integral installations

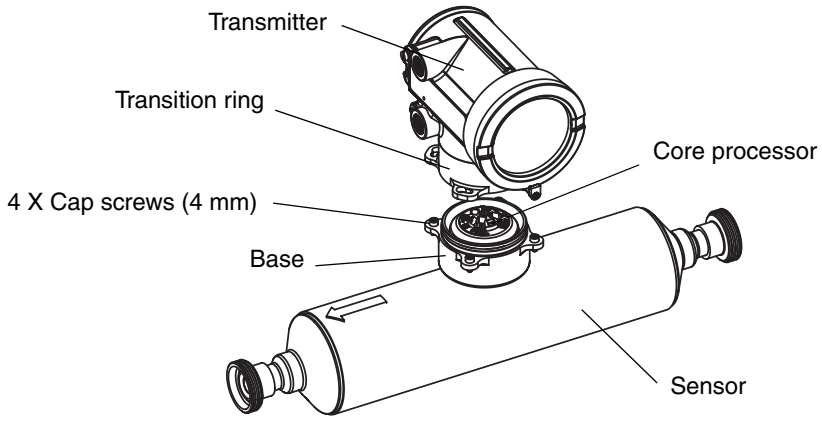


Figure B-9 Transmitter components, junction end-cap removed – 4-wire remote and remote core processor with remote transmitter installations

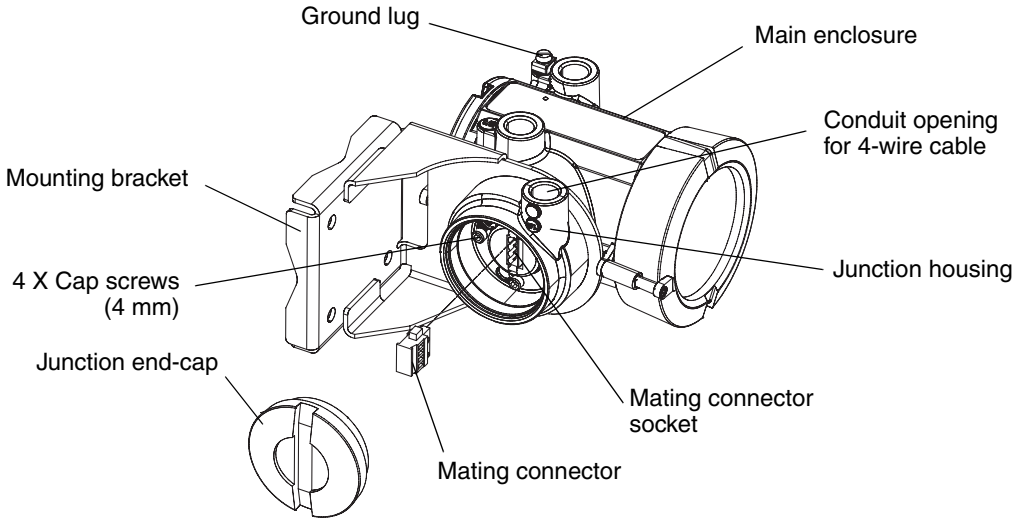


Figure B-10 Transmitter/core processor assembly exploded view – 9-wire remote installations

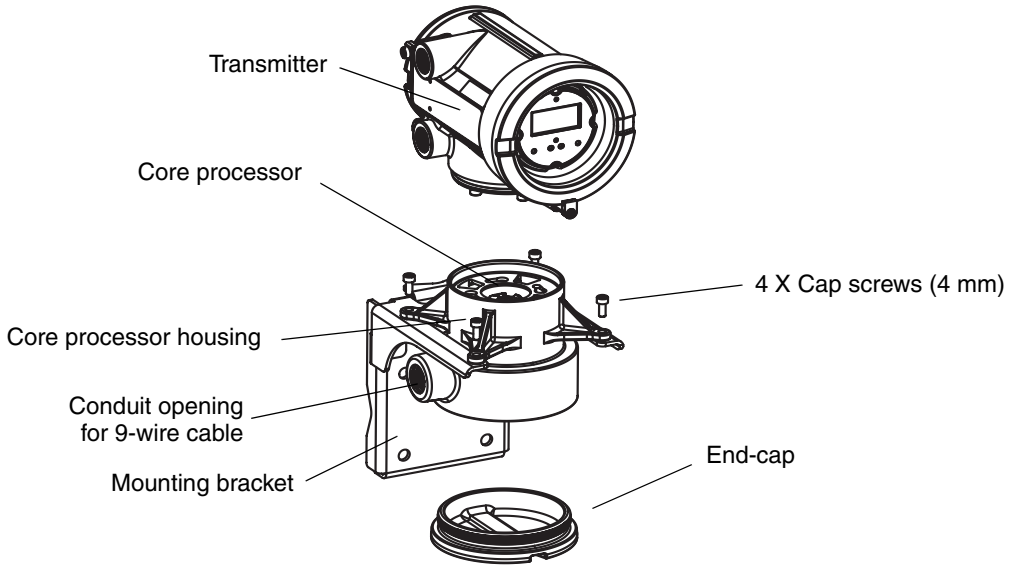


Figure B-11 Remote core processor components

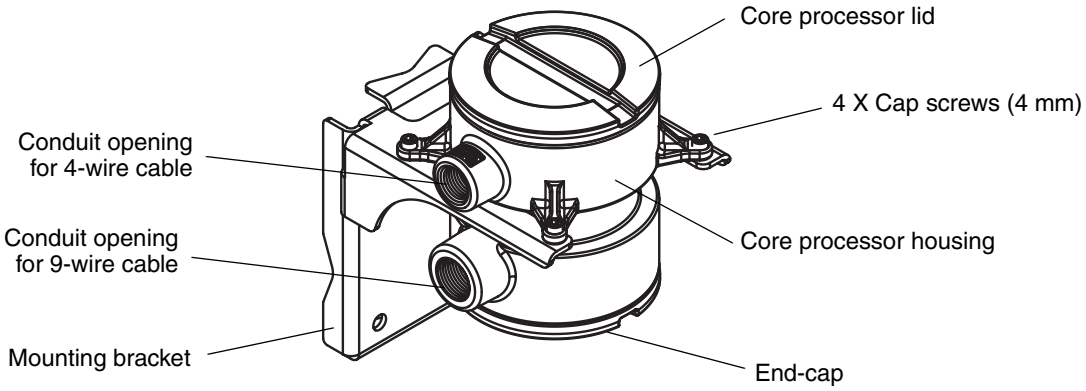


Figure B-12 4-wire cable between the core processor and Model 1700/2700 transmitter mating connector

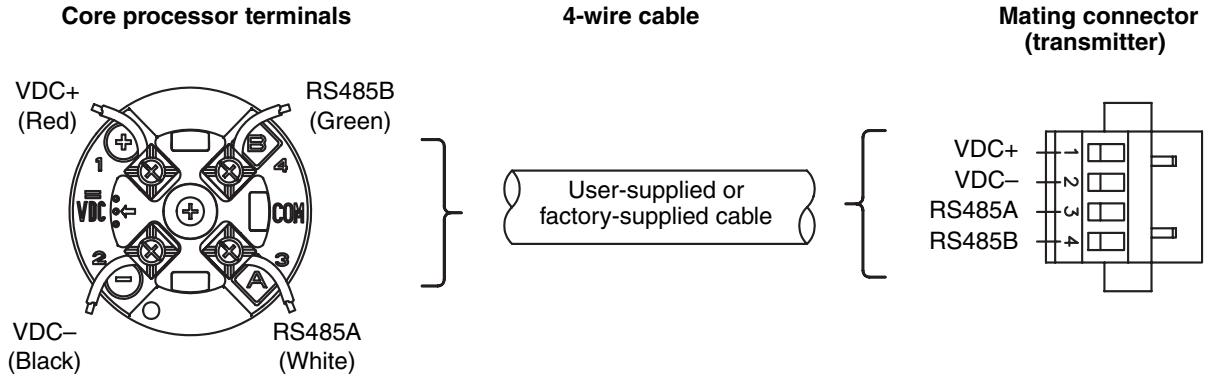


Figure B-13 9-wire cable between sensor junction box and core processor

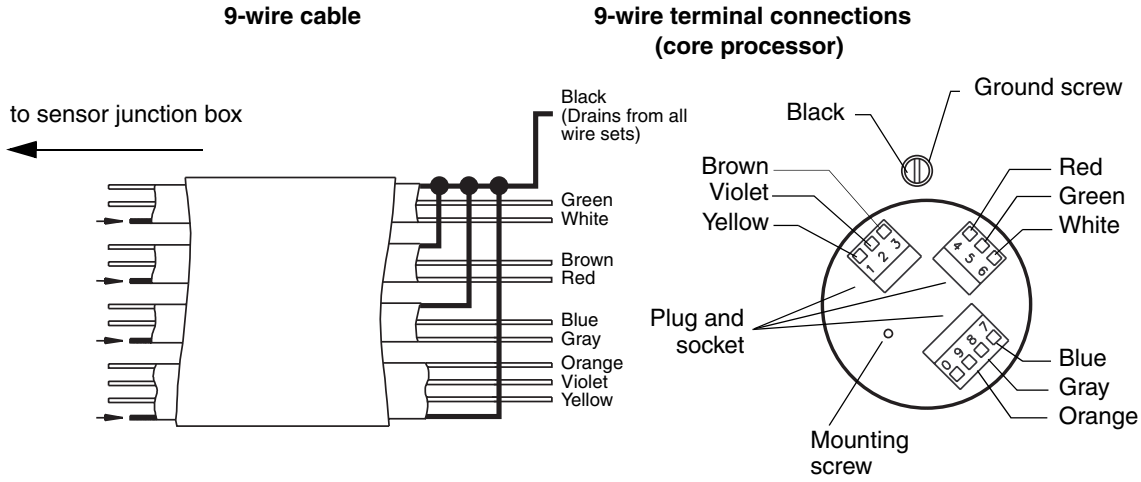


Figure B-14 Power supply terminals – Model 1700/2700 transmitter

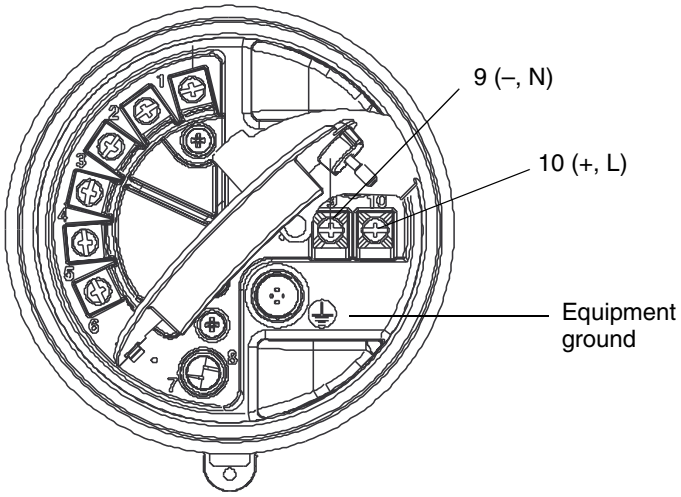
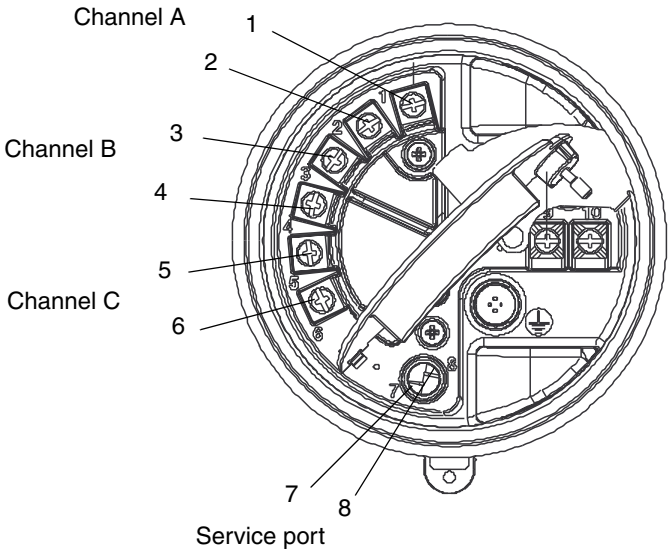


Figure B-15 Output terminals – Model 1700/2700 transmitter



Appendix C
Calibrating the Transmitter

C.1 Overview

This section describes transmitter calibration procedures. Using these procedures, you will be able to:

- Calibrate for density
- Calibrate for temperature

Note: All ProLink II procedures provided in this section assume that your computer is already connected to the transmitter and you have established communication. All ProLink II procedures also assume that you are complying with all applicable safety requirements. See Chapter 3 for more information.

Note: All HART Communicator key sequences in this section assume that you are starting from the "Online" menu. See Chapter 4 for more information.

C.2 About calibration

The flowmeter measures process variables based on fixed points of reference. *Calibration* adjusts those points of reference.

The transmitter is factory calibrated and does not normally need to be calibrated in the field. Calibrate the transmitter only if you must do so to meet regulatory requirements.

Note: Micro Motion recommends using meter factors, rather than calibration, to prove the meter against a regulatory standard or to correct measurement error. Contact Micro Motion before calibrating your flowmeter. For information on meter factors, see Section 8.13.

C.3 Density calibration

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Density calibration includes the following calibration points:

- All sensors:
  - D1 calibration (low-density)
  - D2 calibration (high-density)
- T-Series sensors only:
  - D3 calibration (optional)
  - D4 calibration (optional)

For T-Series sensors, the optional D3 and D4 calibrations could improve the accuracy of the density measurement. If you choose to perform the D3 and D4 calibration:

- Do not perform the D1 or D2 calibration.
- Perform D3 calibration if you have one calibrated fluid.
- Perform both D3 and D4 calibrations if you have two calibrated fluids (other than air and water).

The calibrations that you choose must be performed without interruption, in the order listed here.

Note: Before performing the calibration, record your current calibration parameters. If you are using ProLink II, you can do this by saving the current configuration to a file on the PC. If the calibration fails, restore the known values.

You can calibrate for density with ProLink II software or a Communicator.

C.3.1 Preparing for density calibration

Before beginning density calibration, review the requirements in this section.

Sensor requirements

During density calibration, the sensor must be completely filled with the calibration fluid, and flow through the sensor must be at the lowest rate allowed by your application. This is usually accomplished by closing the shutoff valve downstream from the sensor, then filling the sensor with the appropriate fluid.

Density calibration fluids

D1 and D2 density calibration require a D1 (low-density) fluid and a D2 (high-density) fluid. You may use air and water. If you are calibrating a T-Series sensor, the D1 fluid must be air and the D2 fluid must be water.

⚠ CAUTION

For T-Series sensors, the D1 calibration must be performed on air and the D2 calibration must be performed on water.

For D3 density calibration, the D3 fluid must meet the following requirements:

- Minimum density of 0.6 g/cm^3
- Minimum difference of 0.1 g/cm^3 between the density of the D3 fluid and the density of water. The density of the D3 fluid may be either greater or less than the density of water

For D4 density calibration, the D4 fluid must meet the following requirements:

- Minimum density of 0.6 g/cm^3
- Minimum difference of 0.1 g/cm^3 between the density of the D4 fluid and the density of the D3 fluid. The density of the D4 fluid must be greater than the density of the D3 fluid
- Minimum difference of 0.1 g/cm^3 between the density of the D4 fluid and the density of water. The density of the D4 fluid may be either greater or less than the density of water

C.3.2 Density calibration procedures

To perform a D1 and D2 density calibration:

- With ProLink II, see Figure C-1.
- With a Communicator, see Figure C-2.

To perform a D3 density calibration or a D3 and D4 density calibration:

- With ProLink II, see Figure C-3.
- With a Communicator, see Figure C-4.

Figure C-1 D1 and D2 density calibration – ProLink II

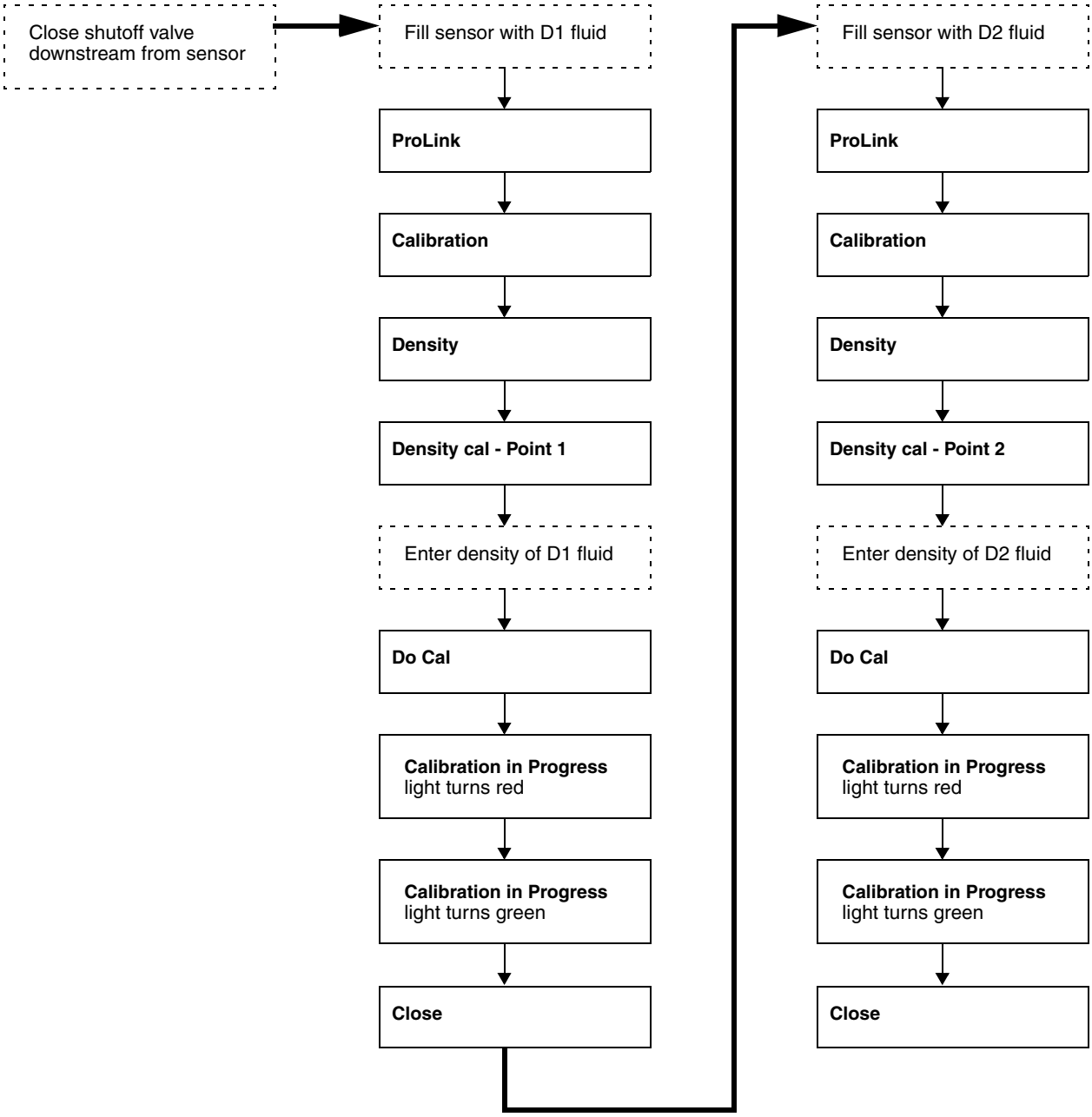


Figure C-2 D1 and D2 density calibration – Communicator

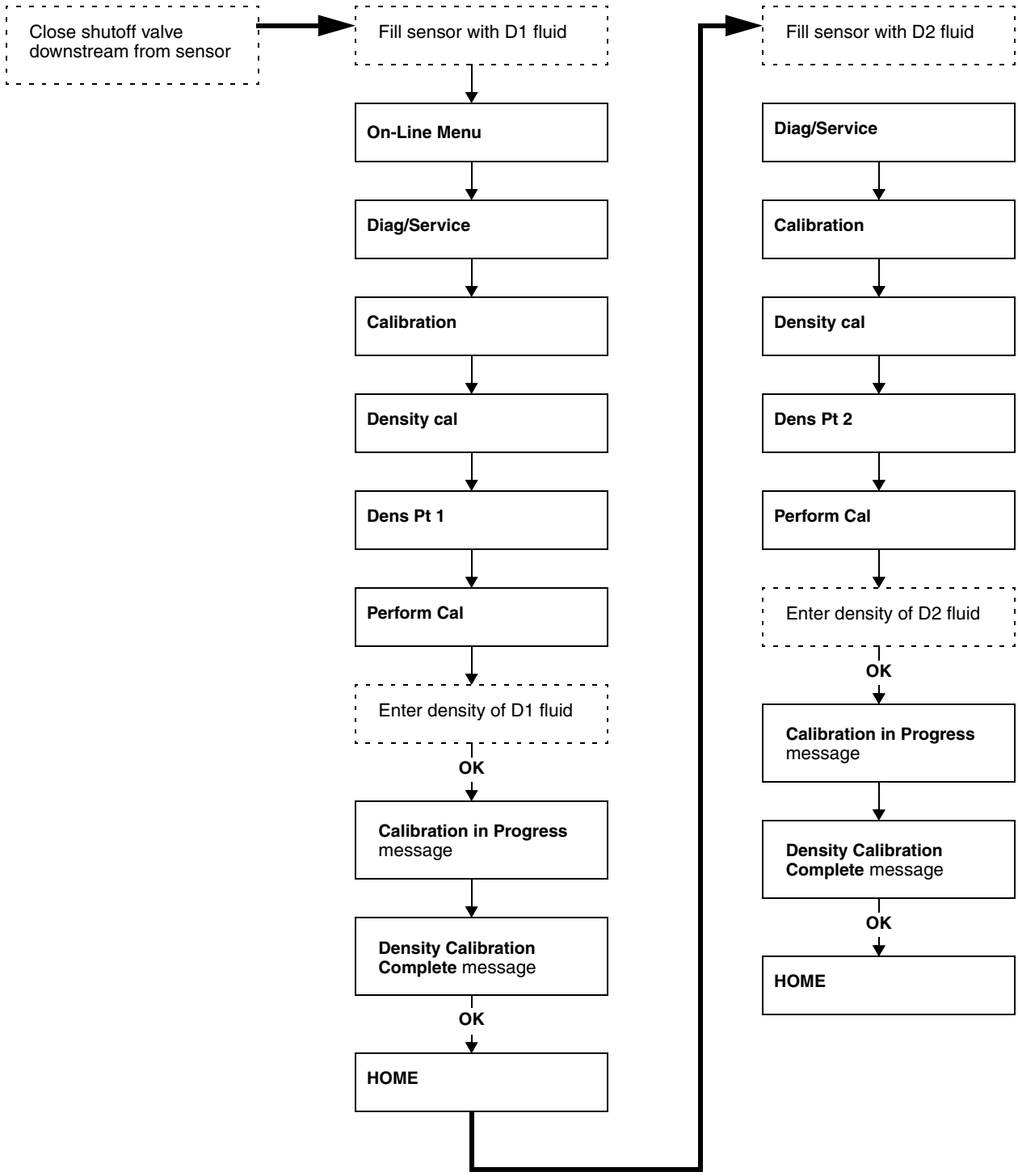


Figure C-3 D3 or D3 and D4 density calibration – ProLink II

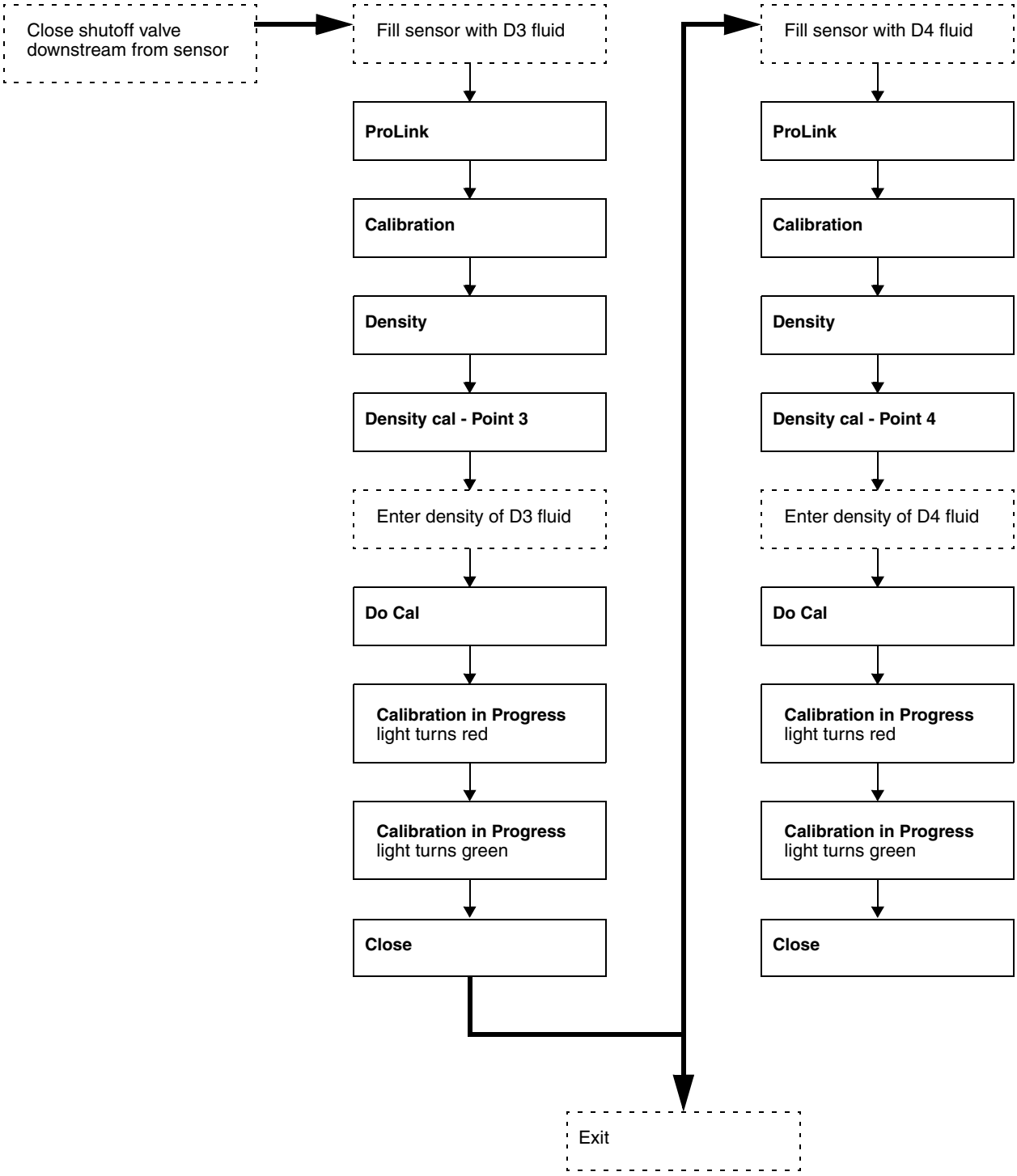
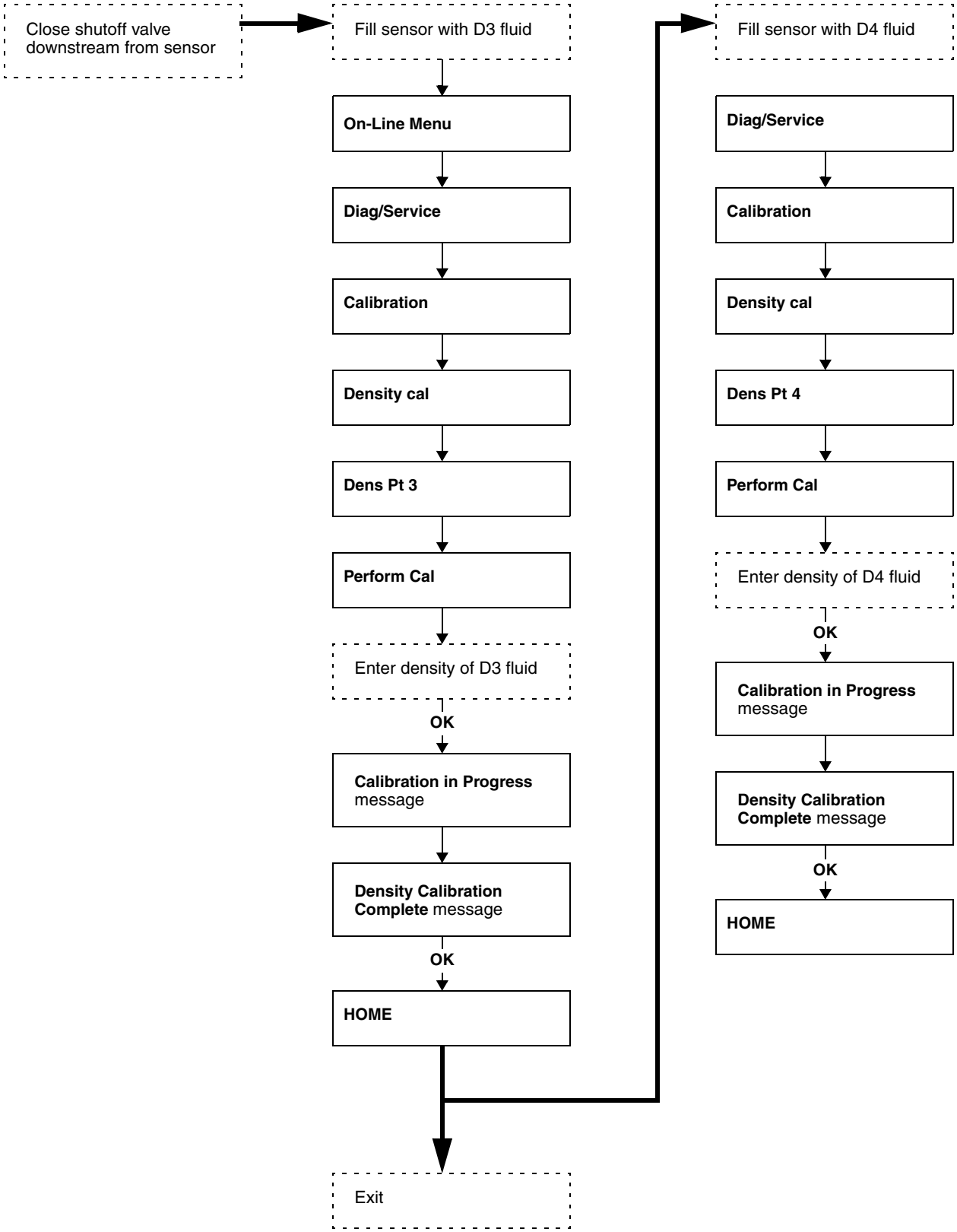


Figure C-4 D3 or D3 and D4 density calibration – Communicator



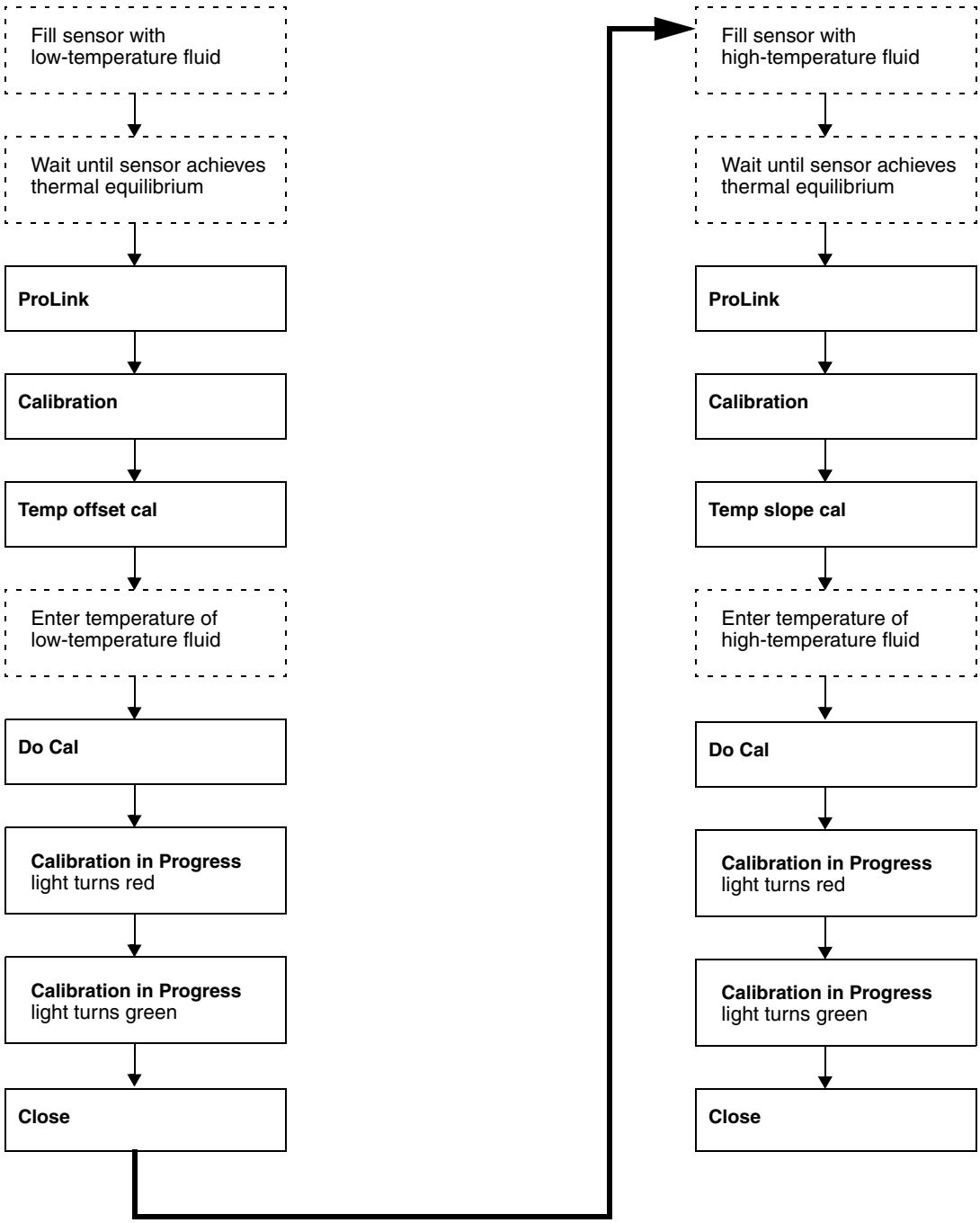
C.4 Temperature calibration

- Model 1500 AN
- Model 1700 AN
- Model 1700 IS
- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

Temperature calibration is a two-part procedure: temperature offset calibration and temperature slope calibration. The entire procedure must be completed without interruption.

You can calibrate for temperature with ProLink II software. See Figure C-5.

Figure C-5 Temperature calibration – ProLink II



Appendix D
Configuring the Enhanced Density Application

D.1 About this chapter

- Model 2500 CIO
- Model 2700 AN
- Model 2700 IS
- Model 2700 CIO

This appendix describes the configuration procedure for the enhanced density application.

Note: The enhanced density application is an optional feature of the Series 2000 transmitter, and may not be installed or enabled on your transmitter. To verify that it is installed, connect to your transmitter using ProLink II, then click on View/Installed Options.

⚠ CAUTION

Changing configuration can affect transmitter operation.

Set control devices for manual operation before changing transmitter configuration.

D.2 Configuration overview

To configure and enable the enhanced density application, the following general steps are required.

1. If you have standard or custom curves (see Section D.3), you may need to load the curve file onto your transmitter. Instructions are provided in Section D.5.1.
2. If you do not have standard or custom curves, you must configure one or more density curves. For detailed instructions, see the ProLink II v2.1 manual, available on the Micro Motion web site, or contact Micro Motion.
3. Specify the active curve. Instructions are provided in Section D.5.2.
4. Perform a density curve trim (optional). Instructions are provided in Section D.6.

Other actions that can be performed include:

- Modifying specific curve parameters (see Section D.7)
- Saving a curve to a file (see Section D.8)

D.3 Application options – Standard or custom curves

When the enhanced density application is purchased, a set of six standard curves may or may not be supplied with the application. These curves are described in Table D-1. For information on obtaining these curves, contact Micro Motion.

In addition, custom curves may be purchased. These curves are defined using customer-supplied data. Custom curves can be installed at the factory, or the customer can load the purchased curve file(s) into the transmitter using ProLink II.

If the standard curves are not appropriate for your application, you did not purchase the custom curves, and you require transmitter output based on enhanced density, you must configure one or more curves to meet your application requirements.

Table D-1 Standard curves

Name	Description
Deg Balling	Curve represents percent extract, by weight, in solution, based on °Balling. For example, if a wort is 10 °Balling and the extract in solution is 100% sucrose, the extract is 10% of the total weight.
Deg Brix	Curve represents a hydrometer scale for sucrose solutions that indicates the percent by weight of sucrose in solution at a given temperature. For example, 40 kg of sucrose mixed with 60 kg of water results in a 40 °Brix solution.
Deg Plato	Curve represents percent extract, by weight, in solution, based on °Plato. For example, if a wort is 10 °Plato and the extract in solution is 100% sucrose, the extract is 10% of the total weight.
HFCS 42	Curve represents a hydrometer scale for HFCS 42 (high fructose corn syrup) solutions that indicates the percent by weight of HFCS in solution.
HFCS 55	Curve represents a hydrometer scale for HFCS 55 (high fructose corn syrup) solutions that indicates the percent by weight of HFCS in solution.
HFCS 90	Curve represents a hydrometer scale for HFCS 90 (high fructose corn syrup) solutions that indicates the percent by weight of HFCS in solution.

D.4 About enhanced density

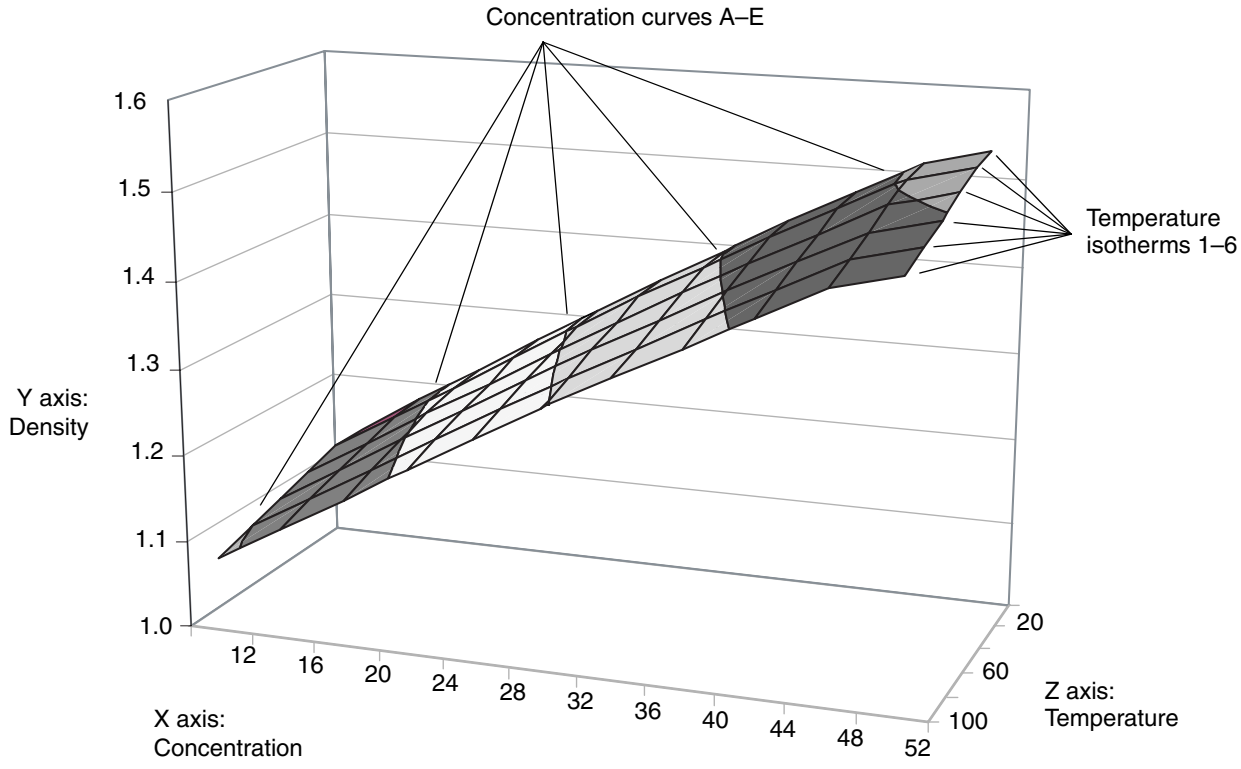
The enhanced density application allows you to select or configure process density curves for proprietary fluids. These curves represent the change in density that results from changes in process temperature and process concentration.

D.4.1 The density curve

The density curve can be represented as a surface in three-dimensional space. See Figure D-1.

Up to six curves may be stored in the transmitter; however, only one curve can be enabled (in use) at a time. When a density curve is enabled, the transmitter uses the selected curve and measured process temperature and density to calculate the *derived variable*. The derived variable is used to calculate several enhanced density process variables, such as ED Density at Ref or ED Concentration. These process variables can be used in transmitter operation just like any standard process variable such as mass flow or volume flow; for example, they can be used to define an event.

Figure D-1 Example density curve



The available process variables depend on the derived variable. Table D-2 lists and defines the derived variables, and also lists the enhanced density process variables that are available with each derived variable.

Note: The Standard derived variable that appears in ProLink II is provided only for backward compatibility, and should not be used.

For user-defined or custom curves, any of the derived variables can be used. However, all curves must be based on the same derived variable. When configuring user-defined curves, select a derived variable that will supply the enhanced density process variables that your application requires.

Standard curves are configured to use the Mass Conc (Dens) derived variable, and cannot be modified to use any other derived variable.

Table D-2 Derived variables and available process variables

Derived variable – ProLink II label and definition	Available process variables					
	Density at reference temperature	Standard volume flow rate	Specific gravity	Concentration	Net mass flow rate	Net volume flow rate
Density @ Ref *Density at reference temperature* Mass/unit volume, corrected to a given reference temperature	✓	✓				
SG *Specific gravity* The ratio of the density of a process fluid at a given temperature to the density of water at a given temperature. The two given temperature conditions do not need to be the same	✓	✓	✓			
Mass Conc (Dens) *Mass concentration derived from reference density* The percent mass of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓	✓	
Mass Conc (SG) *Mass concentration derived from specific gravity* The percent mass of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓	✓	
Volume Conc (Dens) *Volume concentration derived from reference density* The percent volume of solute or of material in suspension in the total solution, derived from reference density	✓	✓		✓		✓
Volume Conc (SG) *Volume concentration derived from specific gravity* The percent volume of solute or of material in suspension in the total solution, derived from specific gravity	✓	✓	✓	✓		✓
Conc (Dens) *Concentration derived from reference density* The mass, volume, weight, or number of moles of solute or of material in suspension in proportion to the total solution, derived from reference density	✓	✓		✓		
Conc (SG) *Concentration derived from specific gravity* The mass, volume, weight, or number of moles of solute or of material in suspension in proportion to the total solution, derived from specific gravity	✓	✓	✓	✓		

D.4.2 Data points

The density curve is defined by "data points," which are user-specified density values. You must enter one data point for each intersection of a temperature isotherm with a concentration curve. For example, Figure D-1 shows 5 concentration curves and 6 temperature isotherms, so 30 data points are required to define this density curve: Point A1, Point A2, . . . Point E6.

Enter data points in the density unit that is currently configured. If the density unit is changed after density curves have been configured, the density curves are automatically updated to use the new density unit.

Note: See Section 6.4 for information on configuring the density unit.

The location of the data points is determined by the values used for the concentration curves and the temperature isotherms at which the data points were measured. The range of temperature isotherms should include the value specified for reference temperature.

D.5 Configuration procedure

Follow the instructions in this section to configure the enhanced density application.

D.5.1 Loading a standard or custom curve

Note: If the required curve is already loaded onto your transmitter, skip this step and continue with Section D.5.2.

If a standard or custom curve has been supplied as a file, you must load it onto the transmitter.

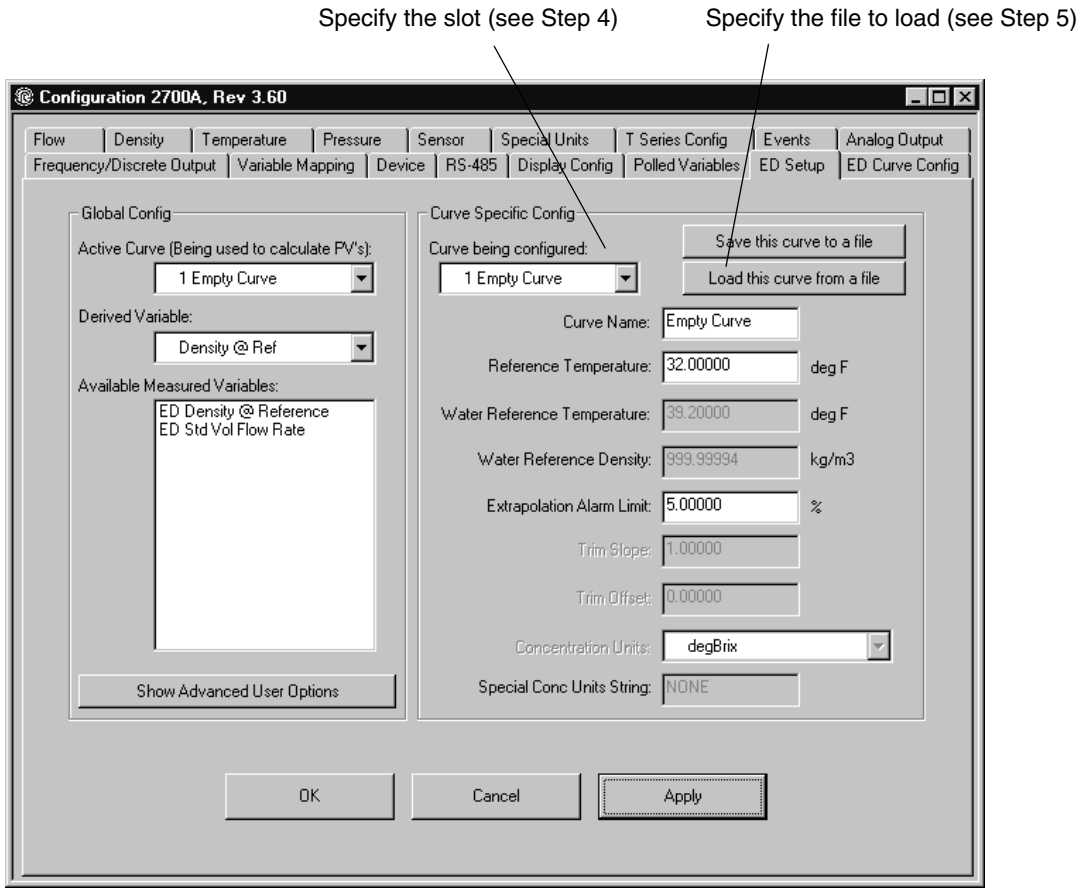
1. Set the transmitter measurement units for density and temperature to the units used by the curve you are loading.
   - For standard curves, see Table D-3 for the units to use.
   - For custom curves, see the information provided by Micro Motion.
   - For information on configuring the measurement units, see Section 6.4.
2. If you are loading a standard curve, set the derived variable to Mass Conc (Dens). If you are loading a custom curve, set the derived variable to the derived variable used by the custom curve.
3. In the **ProLink/Configuration** window, click on the **ED Setup** tab. The window shown in Figure D-2 is displayed.
4. Use the **Curve being configured** dropdown list to specify the slot into which the curve will be loaded (Density Curve 1–6), and click **Apply**.
5. Click the **Load this curve from a file** button and specify the curve file to be loaded.
6. Repeat this process to load as many curves as required. Make sure that all loaded curves use the same derived variable.

Note: Loading a curve that uses a different derived variable will erase all existing curve data.

Table D-3 Units used by standard curves

Curve	Density unit	Temperature unit
Deg Balling	g/cm^3	°F
Deg Brix	g/cm^3	°C
Deg Plato	g/cm^3	°F
HFCS 42	g/cm^3	°C
HFCS 55	g/cm^3	°C
HFCS 90	g/cm^3	°C

Figure D-2 ED Setup window



D.5.2 Specifying the active curve

Only one curve can be active at a time. To specify the curve to use for enhanced density calculations:

1. In the **ProLink/Configuration** window, click on the **ED Setup** tab.
2. Use the **Active Curve** dropdown list to select the active curve from the list of available curves.
3. Click **Apply**.

At this point, any of the available enhanced density process variables, as listed in the **ED Setup** window, can be used in transmitter processing.

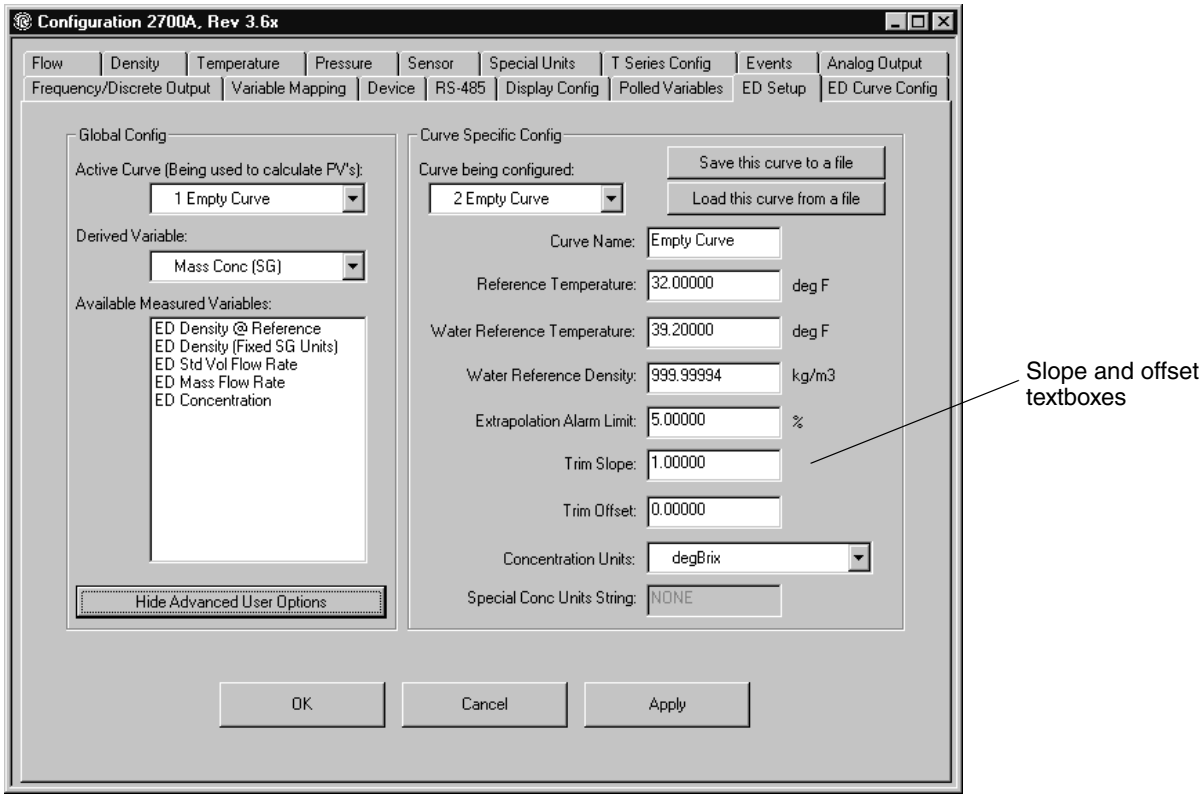
D.6 Density curve trim

Density curve trim is used to bring transmitter output closer to reference values. Density curve trim can be used for standard curves, custom curves, and user-defined curves. Density curve trim is an optional procedure.

To trim a density curve:

1. In the **ED Setup** window, click on the **Show Advanced User Options** button. The window shown in Figure D-3 is displayed.

Figure D-3 ED Setup window – Advanced user options



2. Select the curve to be trimmed.
3. For the configured derived variable (mass concentration, density at reference temperature, etc.), compare transmitter data with laboratory samples at a few temperature and concentration points.
4. Calculate the slope and offset required to bring the transmitter output closer to the laboratory values.
5. Enter the slope and offset values in the **Trim Slope** and **Trim Offset** textboxes.
6. Click **Apply**.

D.7 Modifying a density curve

An existing density curve may be modified. The following parameters can be modified without affecting the enhanced density calculations:

- Curve name
- Concentration unit label and optional text string
- Extrapolation alarm limit

Note: As the value for extrapolation alarm limit is increased, the probability of inaccurate enhanced density calculations also increases. Micro Motion recommends using the default value for extrapolation alarm limit.

Do not change any other parameters. In particular, if you change the derived variable, all data are erased for all existing curves.

D.8 Saving a density curve

Micro Motion recommends that all curves be saved to a file.

To save a curve to a file:

1. In the **ProLink/Configuration** window, click on the **ED Setup** tab.
2. Use the **Curve being configured** dropdown list to specify the curve to save, and click **Apply**.
3. Click the **Save this curve to a file** button and specify the file name and location.
4. Repeat these steps for all density curves on your transmitter.

Appendix E
Menu Flowcharts – Model 1500 AN Transmitters

E.1 Overview

This appendix provides the following menu flowcharts for the Model 1500 AN transmitter:

- ProLink II menus
  - Configuration menu – Figures E-1 and E-2
  - Operating menus – Figure E-3
- Communicator 375 menus – Figures E-4 through E-8

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

E.2 Model 1500 output board

The Model 1500 transmitter is designed as an analog transmitter, i.e., a transmitter with the analog output board. However, for technical reasons it is built on the CIO output board. Accordingly, when you select a menu option that displays the output board, the CIO board is shown. This is normal, and does not affect actual transmitter outputs or operation.

E.3 Communication tool requirements

E.3.1 ProLink II

ProLink II v2.1 is required for full support of the Model 1500 AN transmitter. If you use previous versions of ProLink II, you will not be able to perform all functions.

The ProLink II menus in this appendix are based on ProLink II v2.1.

E.3.2 Communicator

The Model 1500 transmitter requires the 375 Field Communicator. The Model 1500 transmitter is not supported by the 275 HART Communicator.

When the 375 Field Communicator is first connected to the Model 1500 transmitter, a warning message may be displayed. Press **CONT** to continue using the 375 Field Communicator with the Model 1500.

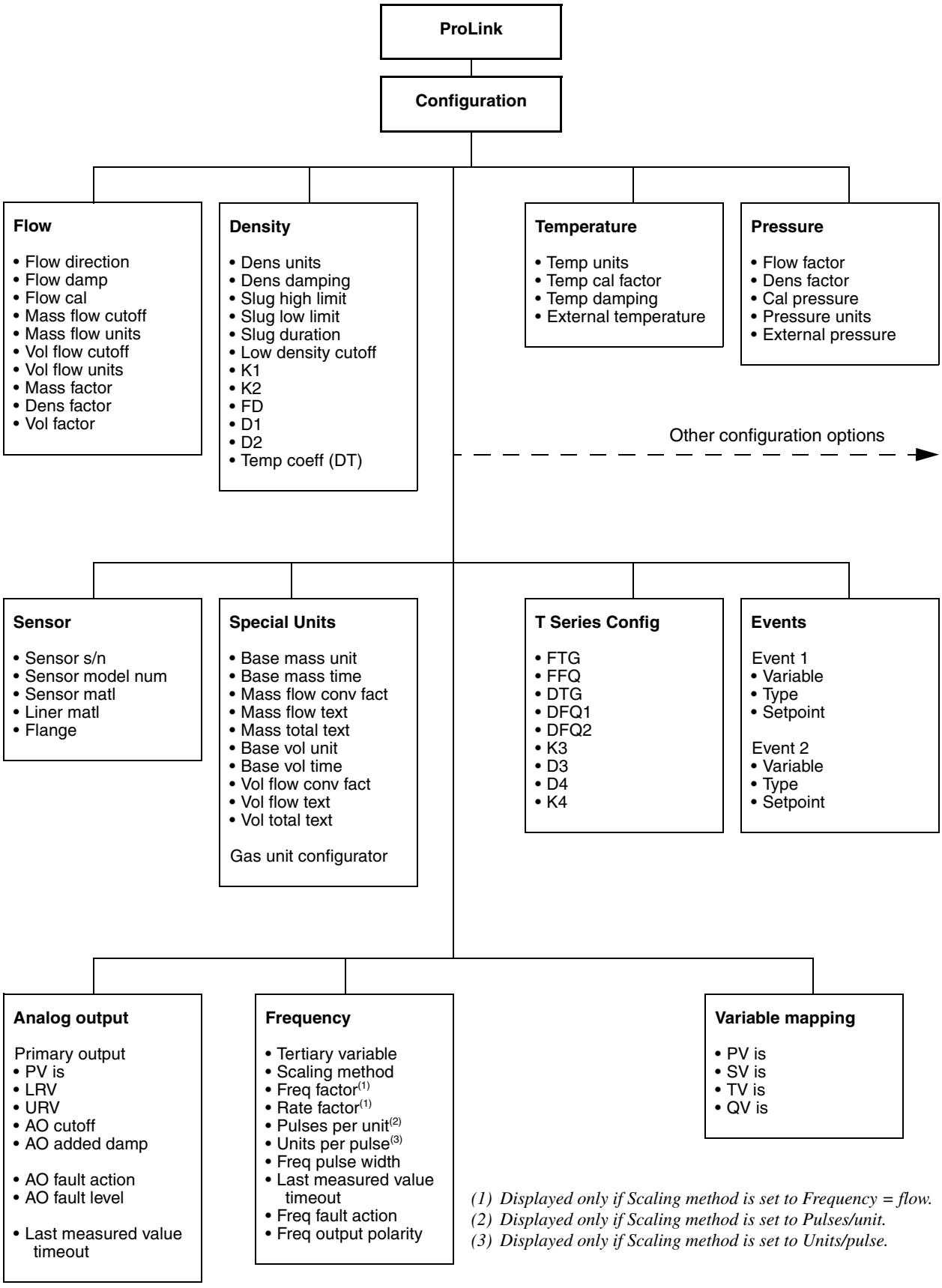
E.4 Version information

These menu flowcharts are based on:

- Transmitter software v4.1
- Core processor software v2.1
- ProLink II v2.1
- 375 Field Communicator device rev4, DD rev1

Menus may vary slightly for different versions of these components.

Figure E-1 ProLink II configuration menu



(1) Displayed only if Scaling method is set to Frequency = flow.
(2) Displayed only if Scaling method is set to Pulses/unit.
(3) Displayed only if Scaling method is set to Units/pulse.

Figure E-2 ProLink II configuration menu (continued)

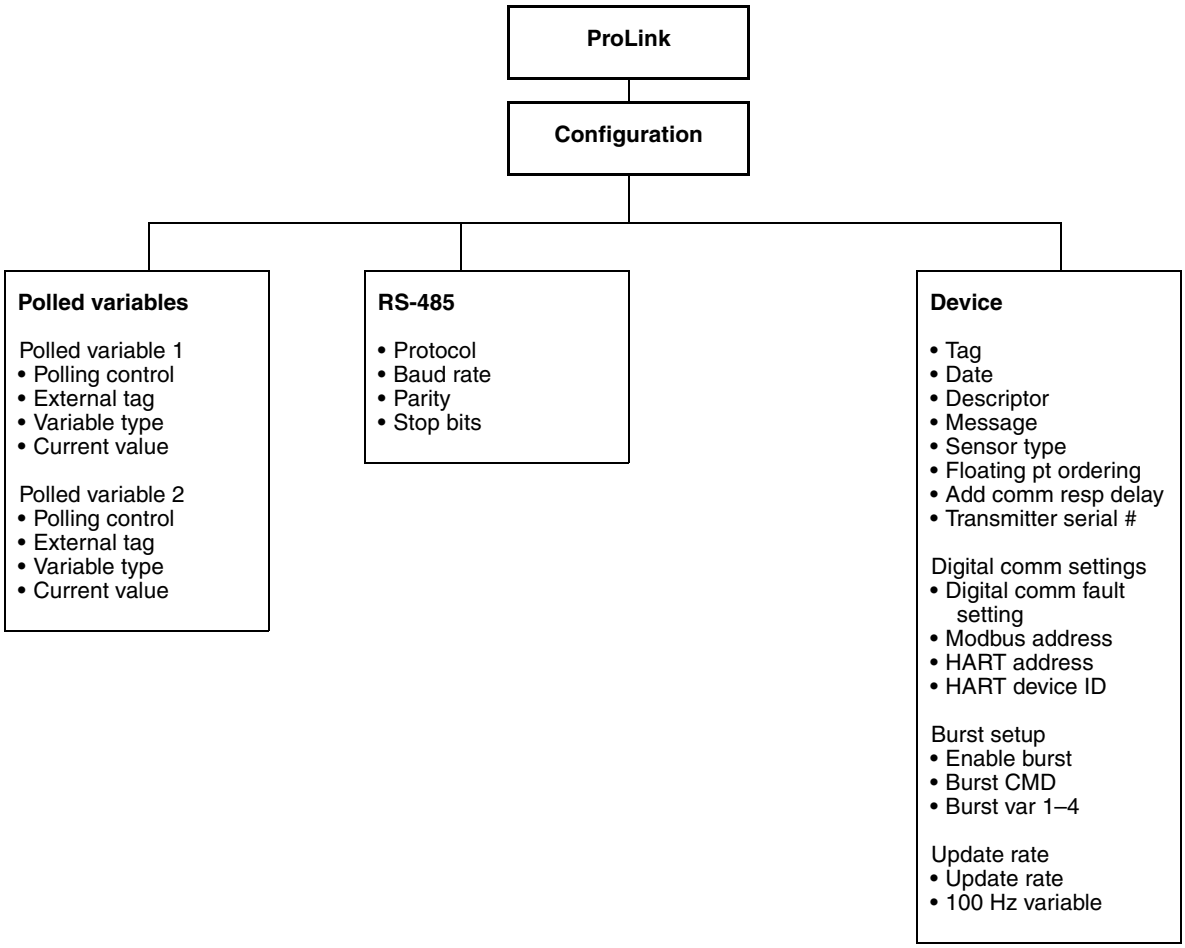
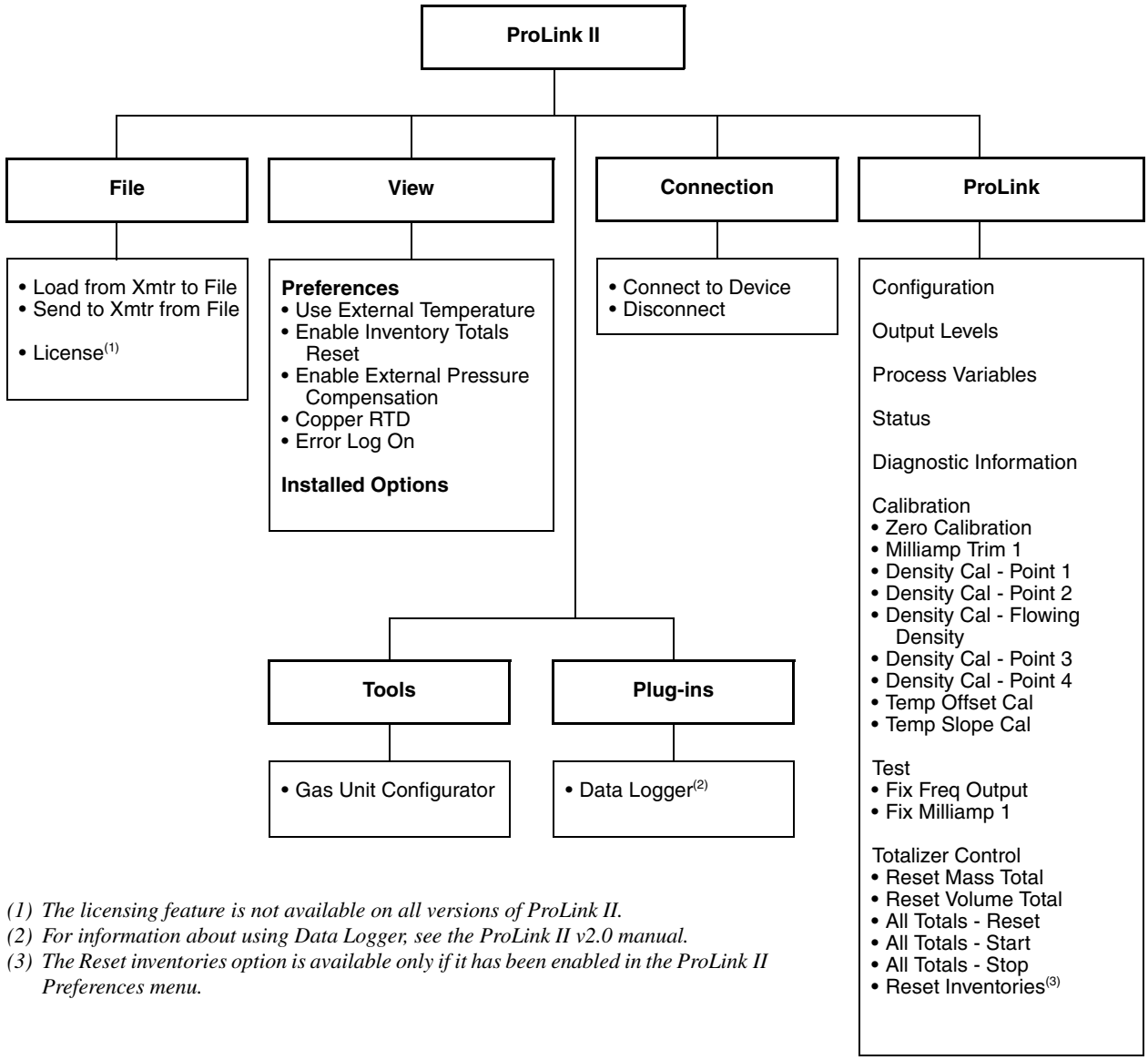


Figure E-3 ProLink II operating menus



(1) The licensing feature is not available on all versions of ProLink II.
(2) For information about using Data Logger, see the ProLink II v2.0 manual.
(3) The Reset inventories option is available only if it has been enabled in the ProLink II Preferences menu.

Figure E-4 Communicator menus

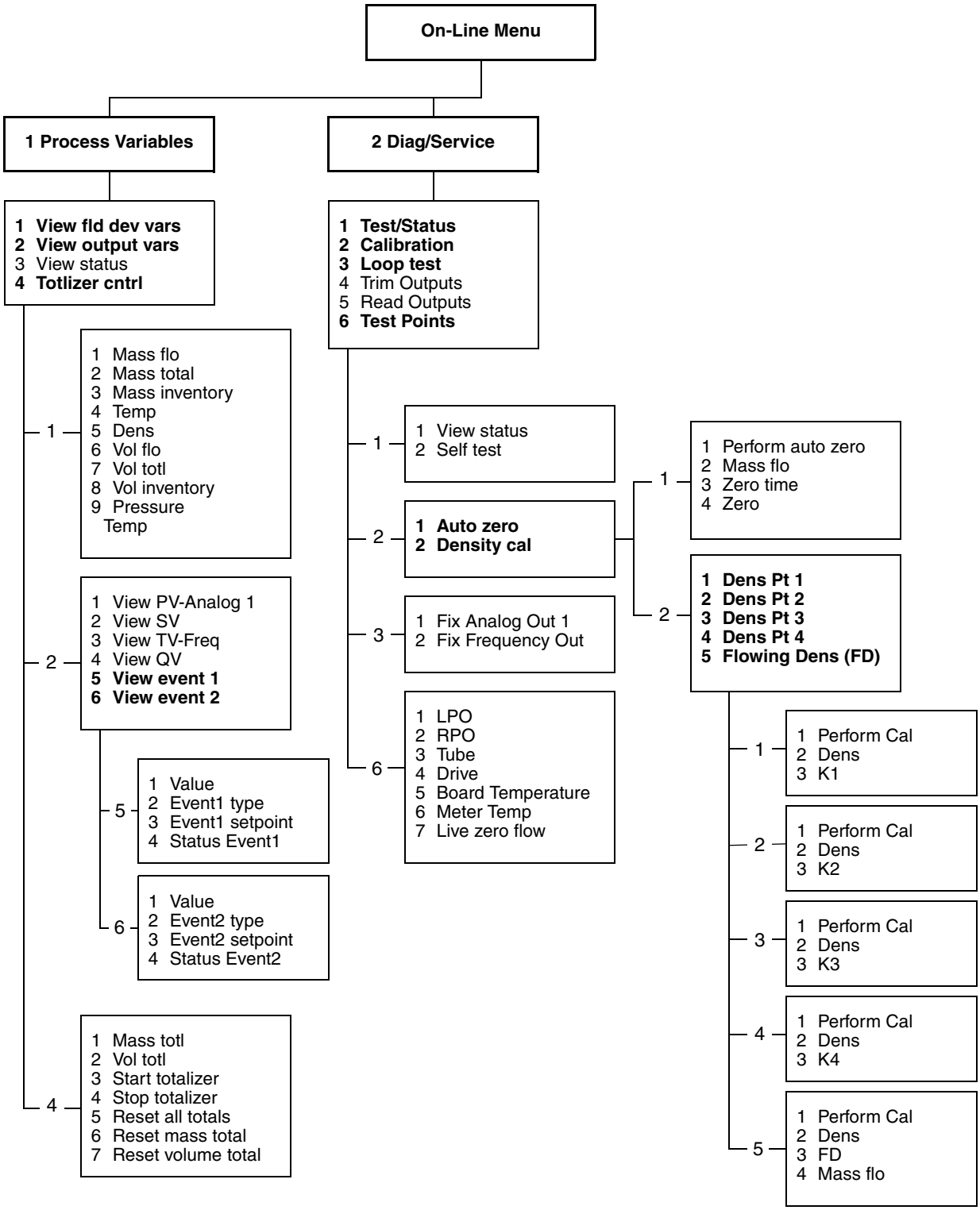
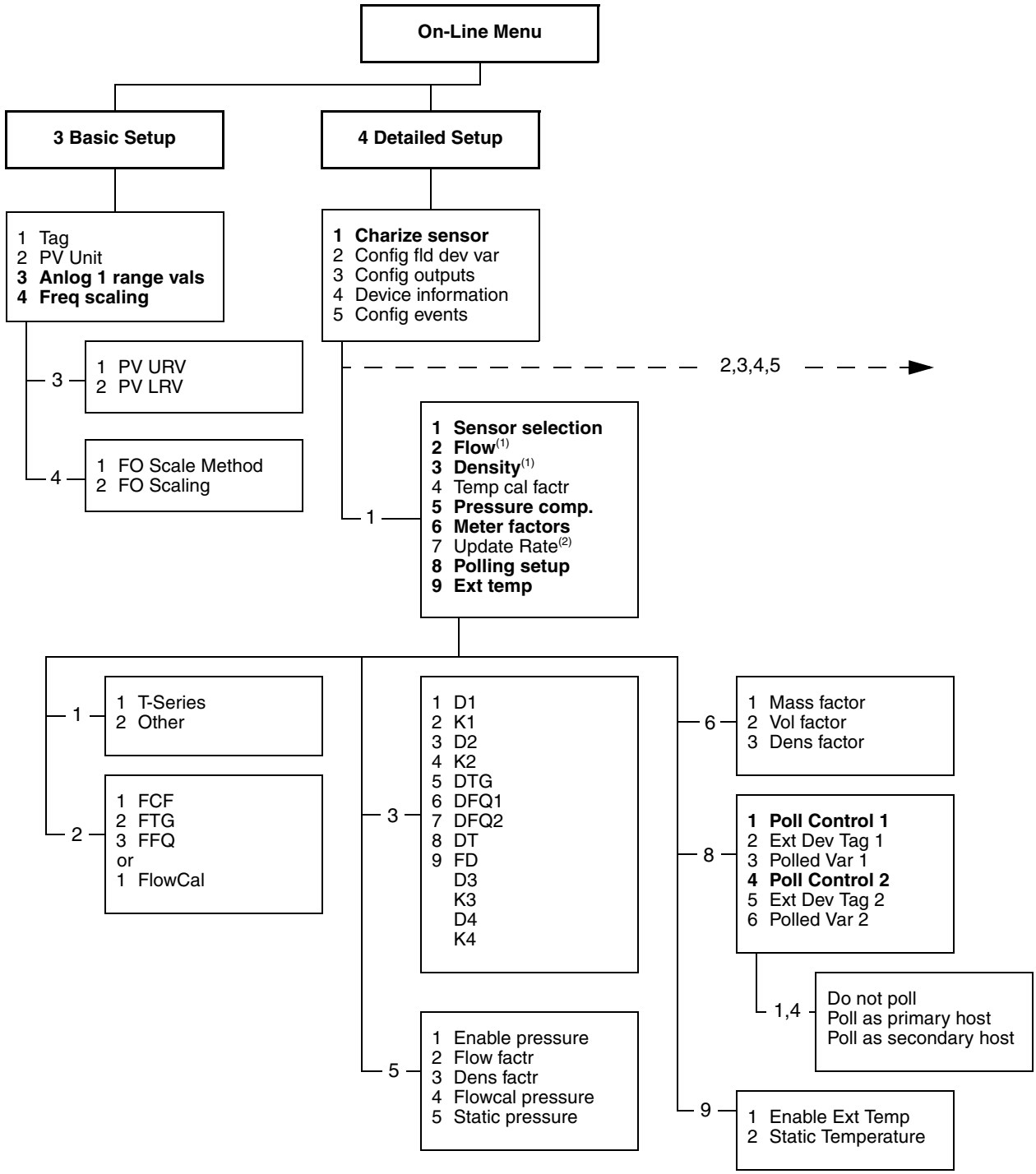


Figure E-5 Communicator menus (confined)



(1) Different flow and density parameters are displayed depending on your sensor selection. Menu numbers are adjusted accordingly. For more information, see Section 6.2.

(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.

Figure E-6 Communicator menus (confirmed)

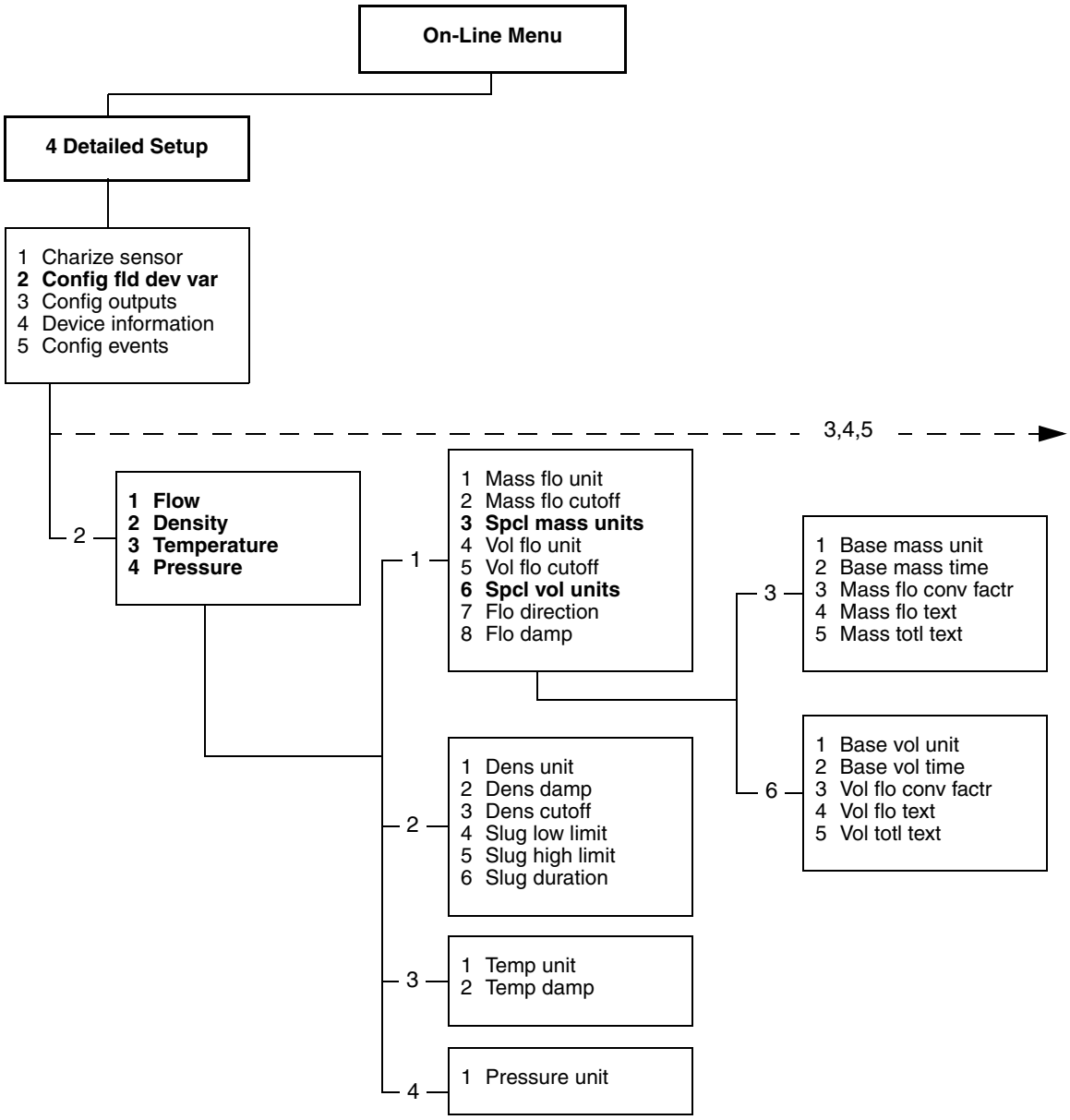


Figure E-7 Communicator menus (confined)

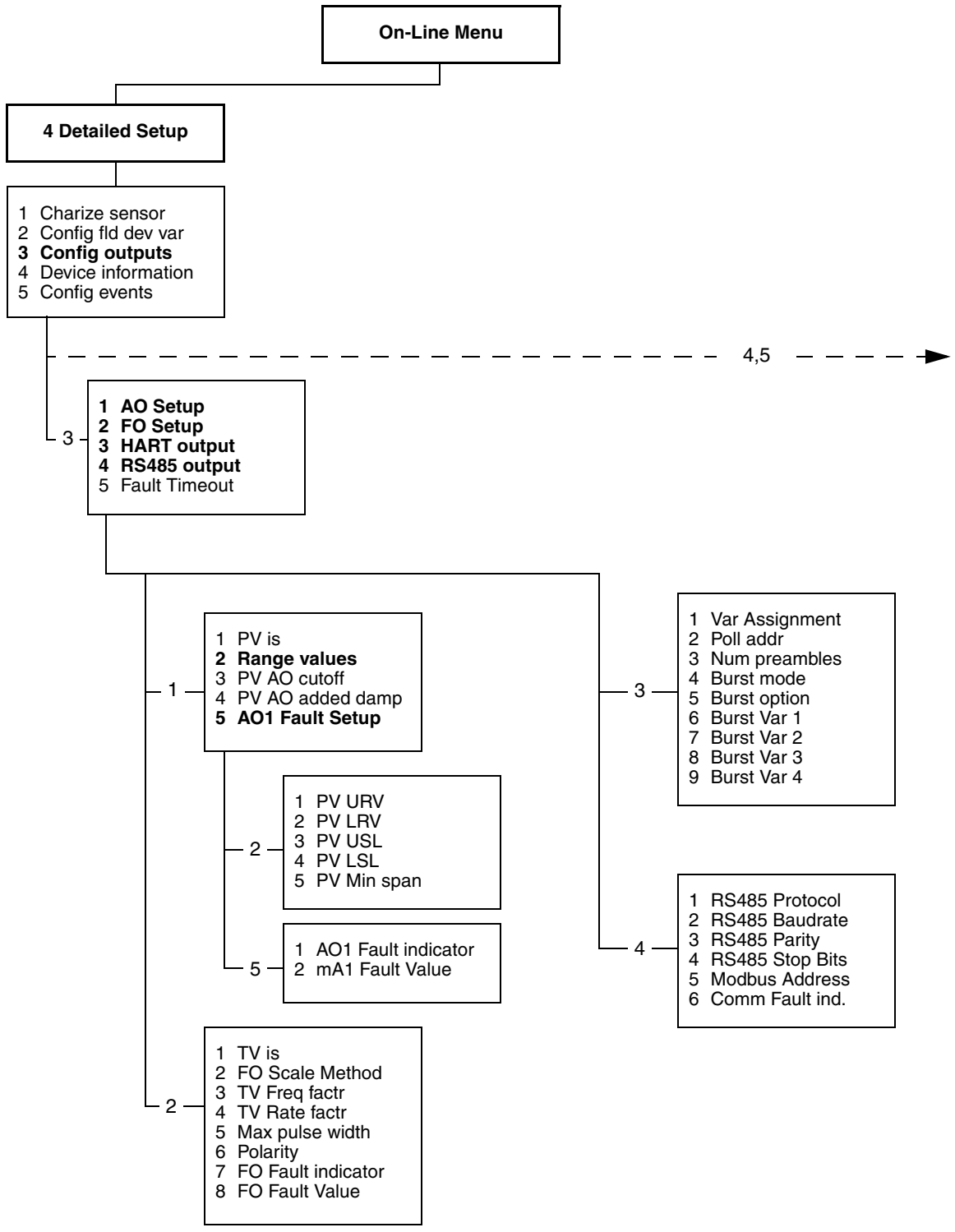
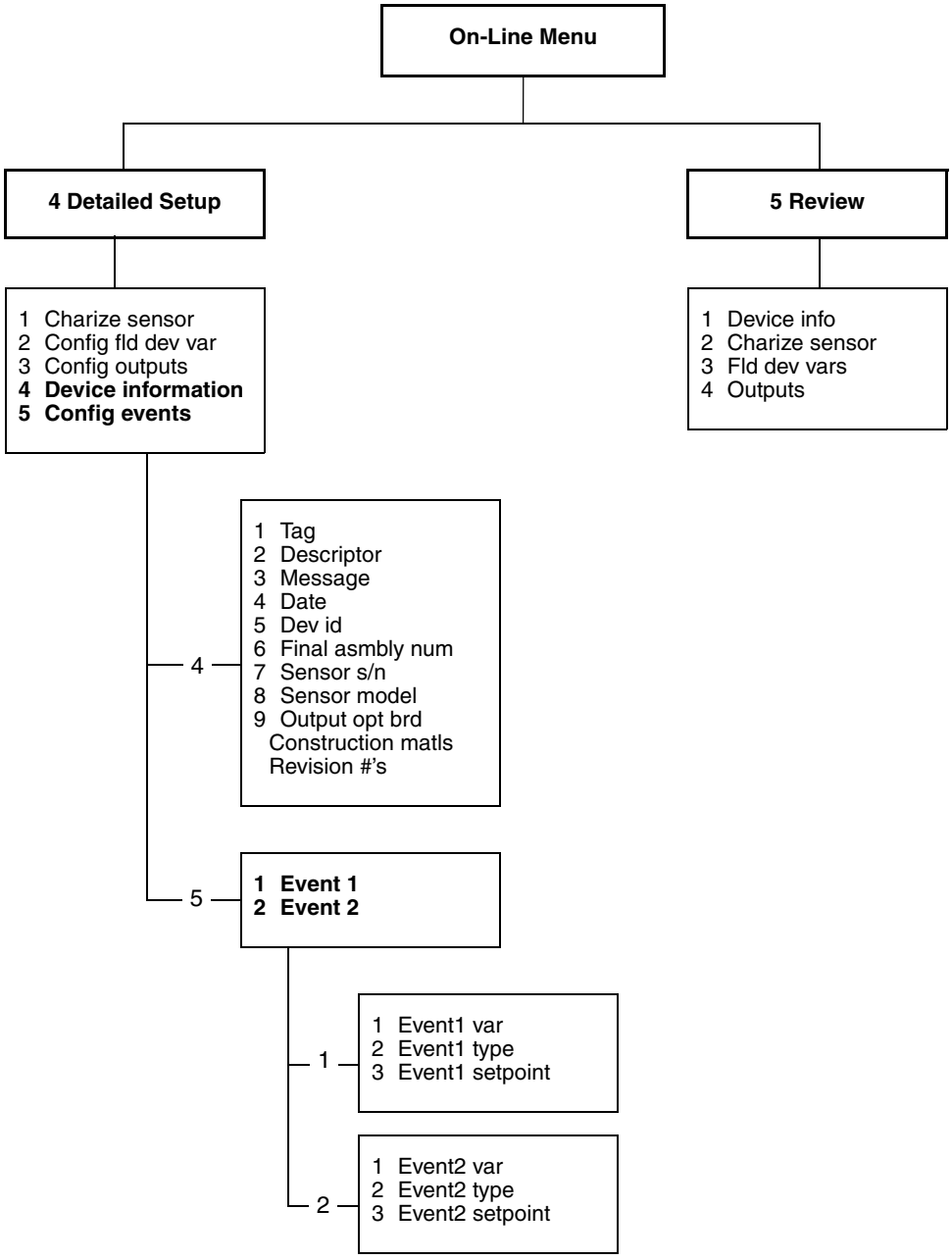


Figure E-8 Communicator menus (confirmed)



Appendix F
Menu Flowcharts – Model 2500 CIO Transmitters

F.1 Overview

This appendix provides the following menu flowcharts for the Model 2500 CIO transmitter:

- ProLink II menus
  - Configuration menus – Figures F-1 and F-2
  - Operating menus – Figure F-3
- Communicator menus – Figures F-4 through F-8

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

F.2 Communication tool requirements

F.2.1 ProLink II

ProLink II v2.0 is required for full support of the Model 2500 CIO transmitter. If you use previous versions of ProLink II, you will not be able to perform all functions.

F.2.2 Communicator

For full support of the Model 2500 CIO transmitter, you must use the 375 Field Communicator. The 275 HART Communicator provides partial support (see Section 4.2).

The Communicator menus in this appendix are based on the 375 Field Communicator.

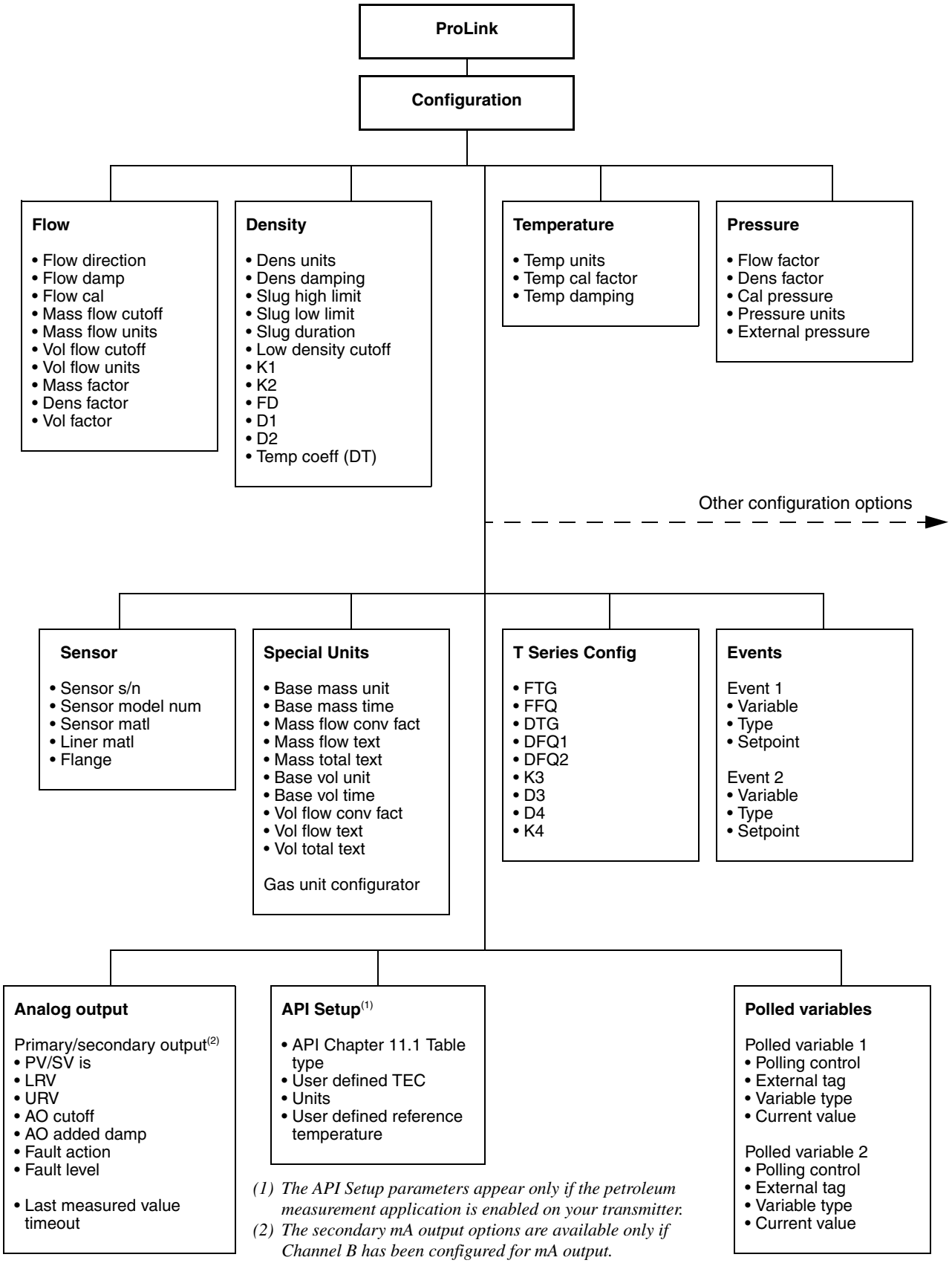
F.3 Version information

These menu flowcharts are based on:

- Transmitter software v4.0
- Core processor software v2.1
- ProLink II v2.1
- 375 Field Communicator device rev4, DD rev1 (menus apply also to DD rev2)

Menus may vary slightly for different versions of these components.

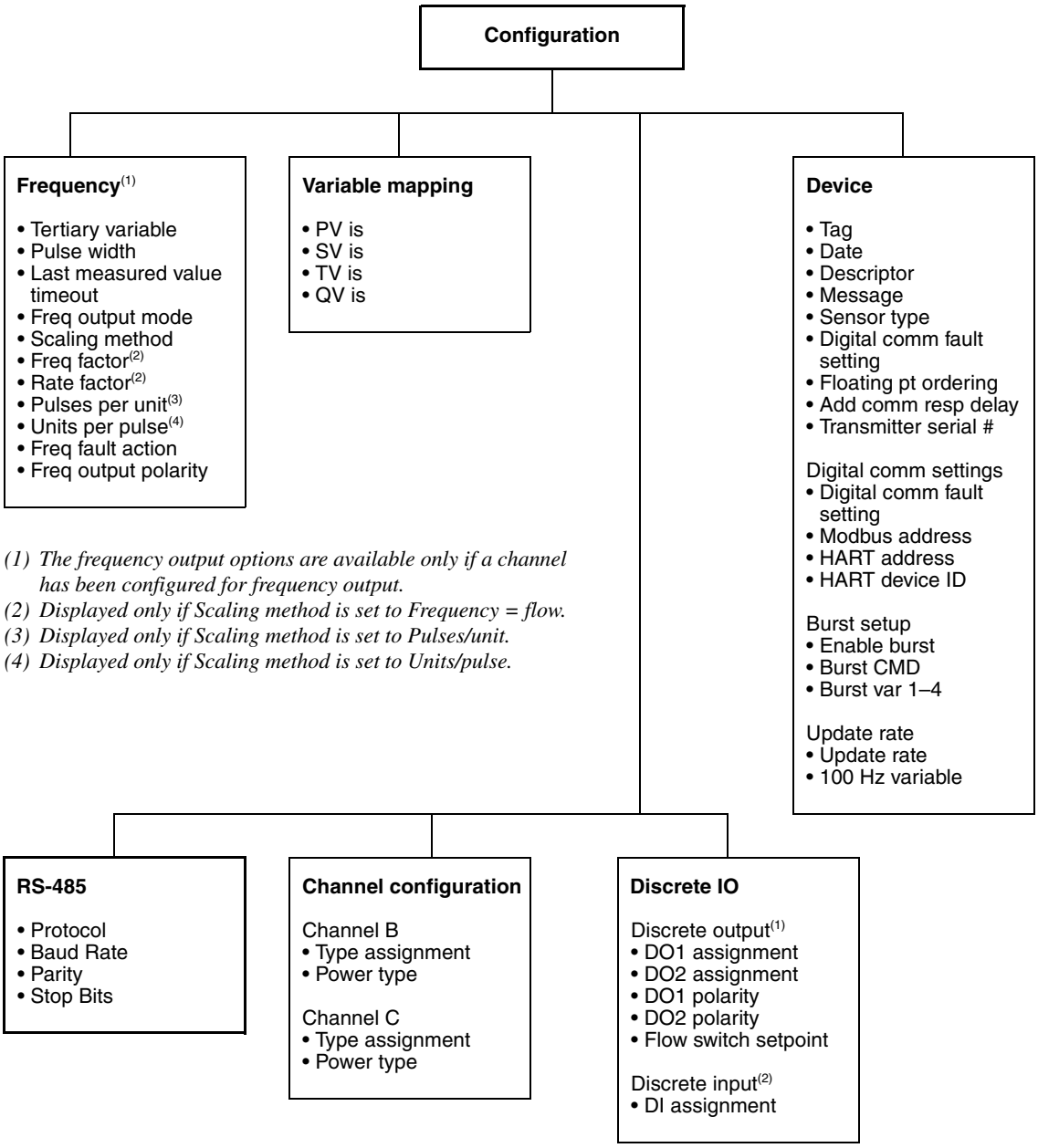
Figure F-1 ProLink II configuration menu



(1) The API Setup parameters appear only if the petroleum measurement application is enabled on your transmitter.

(2) The secondary mA output options are available only if Channel B has been configured for mA output.

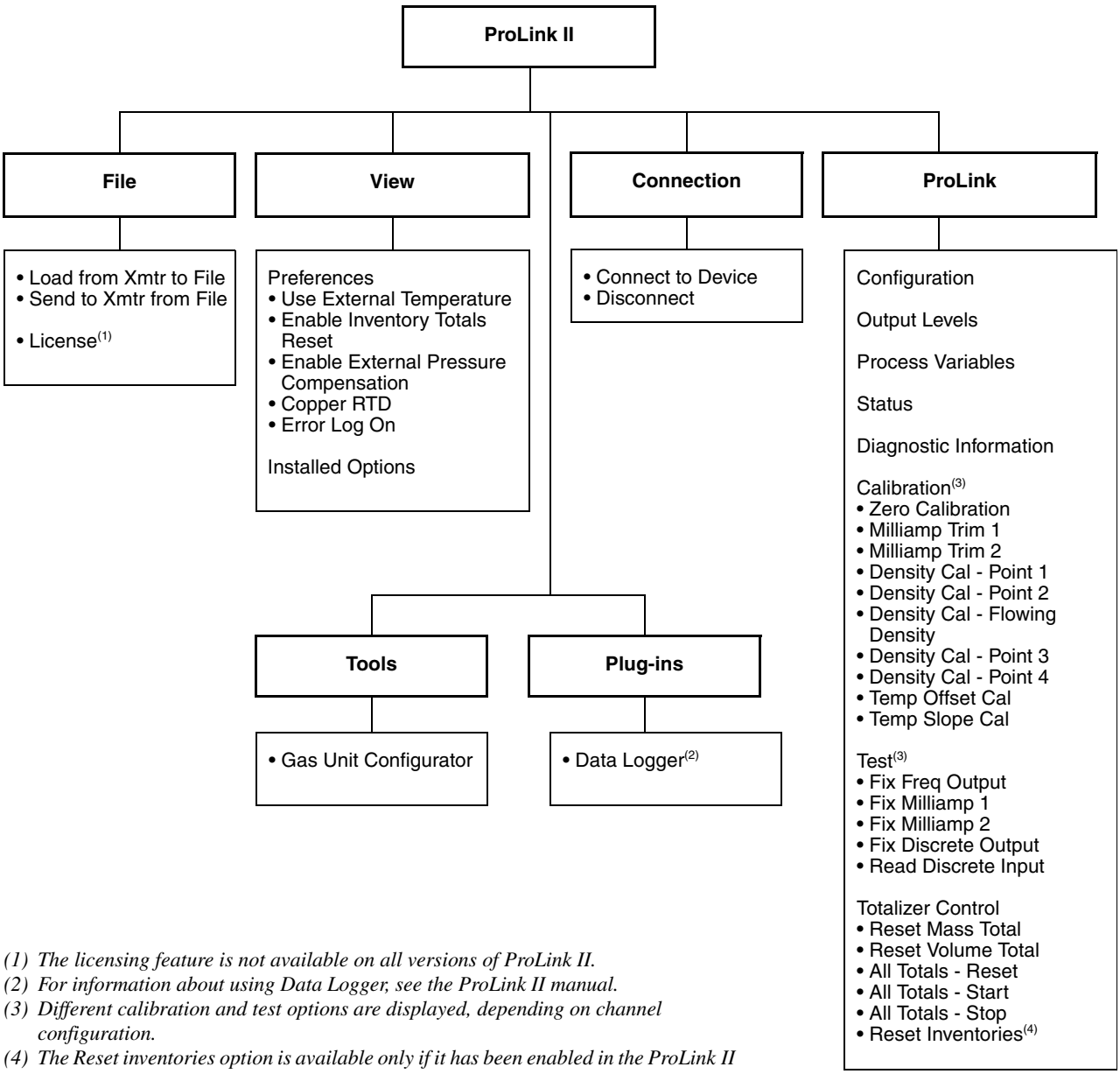
Figure F-2 ProLink II configuration menu (continued)



(1) The frequency output options are available only if a channel has been configured for frequency output.
(2) Displayed only if Scaling method is set to Frequency = flow.
(3) Displayed only if Scaling method is set to Pulses/unit.
(4) Displayed only if Scaling method is set to Units/pulse.

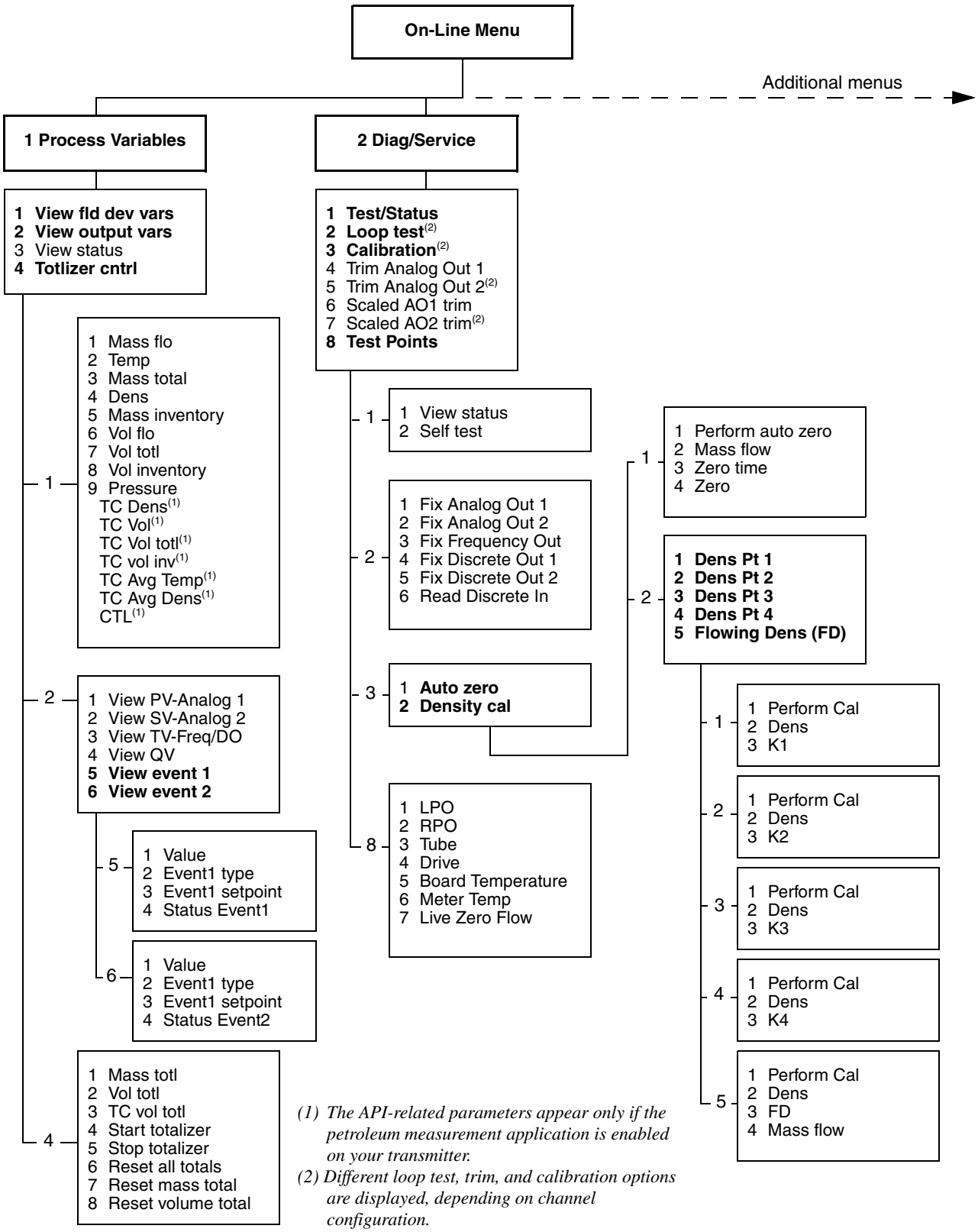
(1) The discrete output options are available only if a channel has been configured for discrete output.
(2) The discrete input options are available only if a channel has been configured for discrete input.

Figure F-3 ProLink II operating menus



(1) The licensing feature is not available on all versions of ProLink II.
(2) For information about using Data Logger, see the ProLink II manual.
(3) Different calibration and test options are displayed, depending on channel configuration.
(4) The Reset inventories option is available only if it has been enabled in the ProLink II Preferences menu.

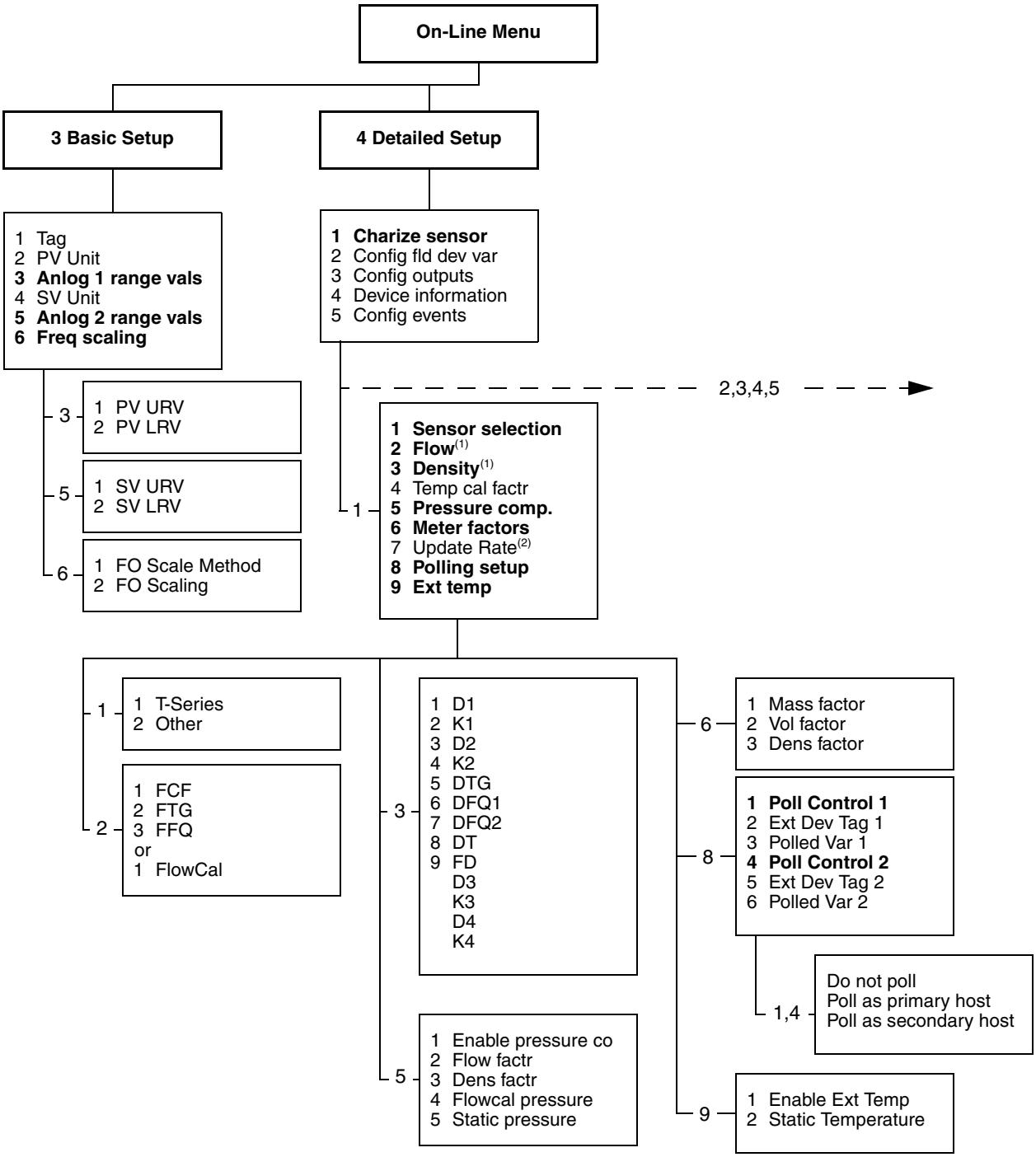
Figure F-4 Communicator menus



(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

(2) Different loop test, trim, and calibration options are displayed, depending on channel configuration.

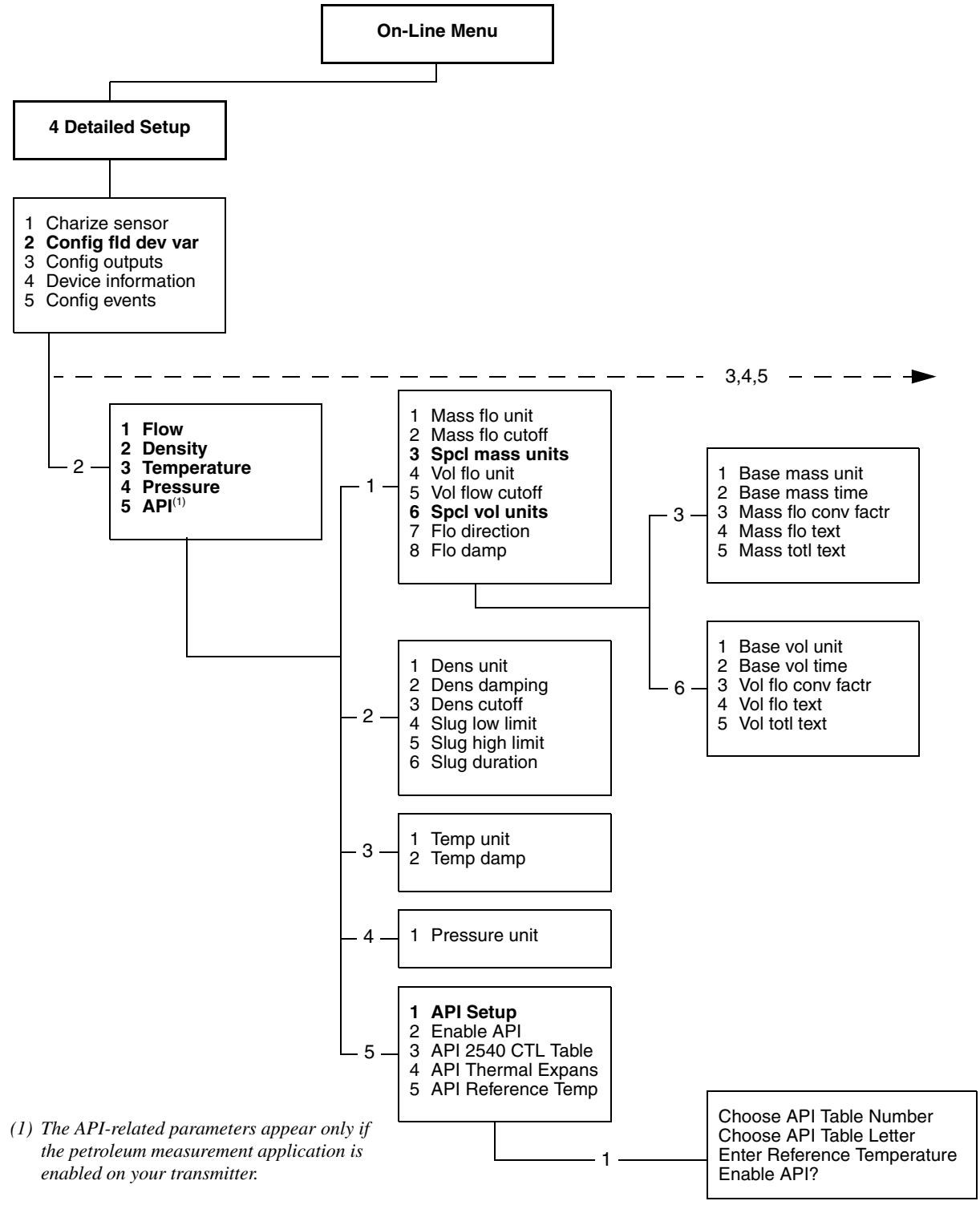
Figure F-5 Communicator menus (confined)



(1) Different flow and density parameters are displayed depending on your sensor selection. Menu numbers are adjusted accordingly. For more information, see Section 6.2.

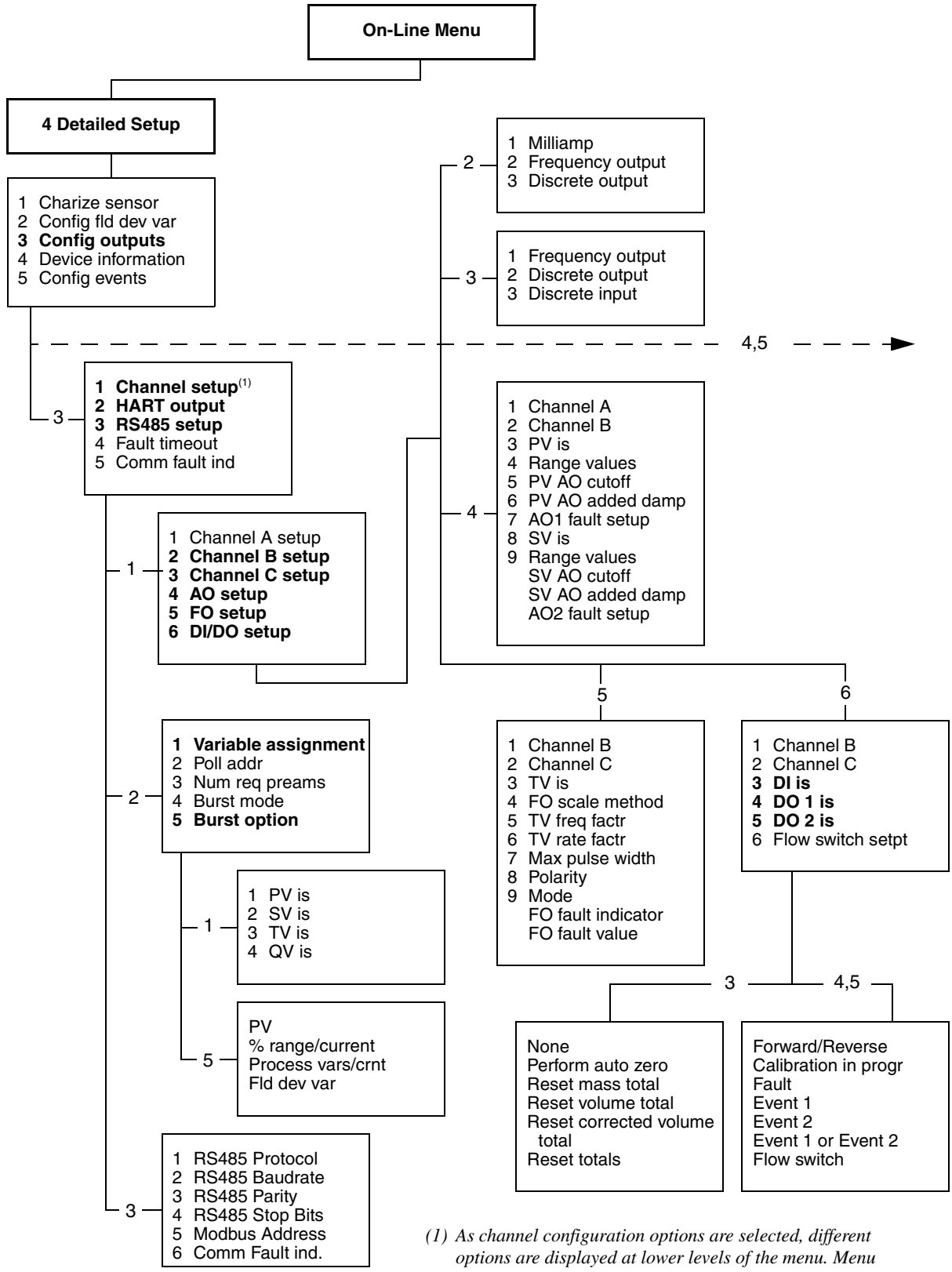
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.

Figure F-6 Communicator menus (confined)



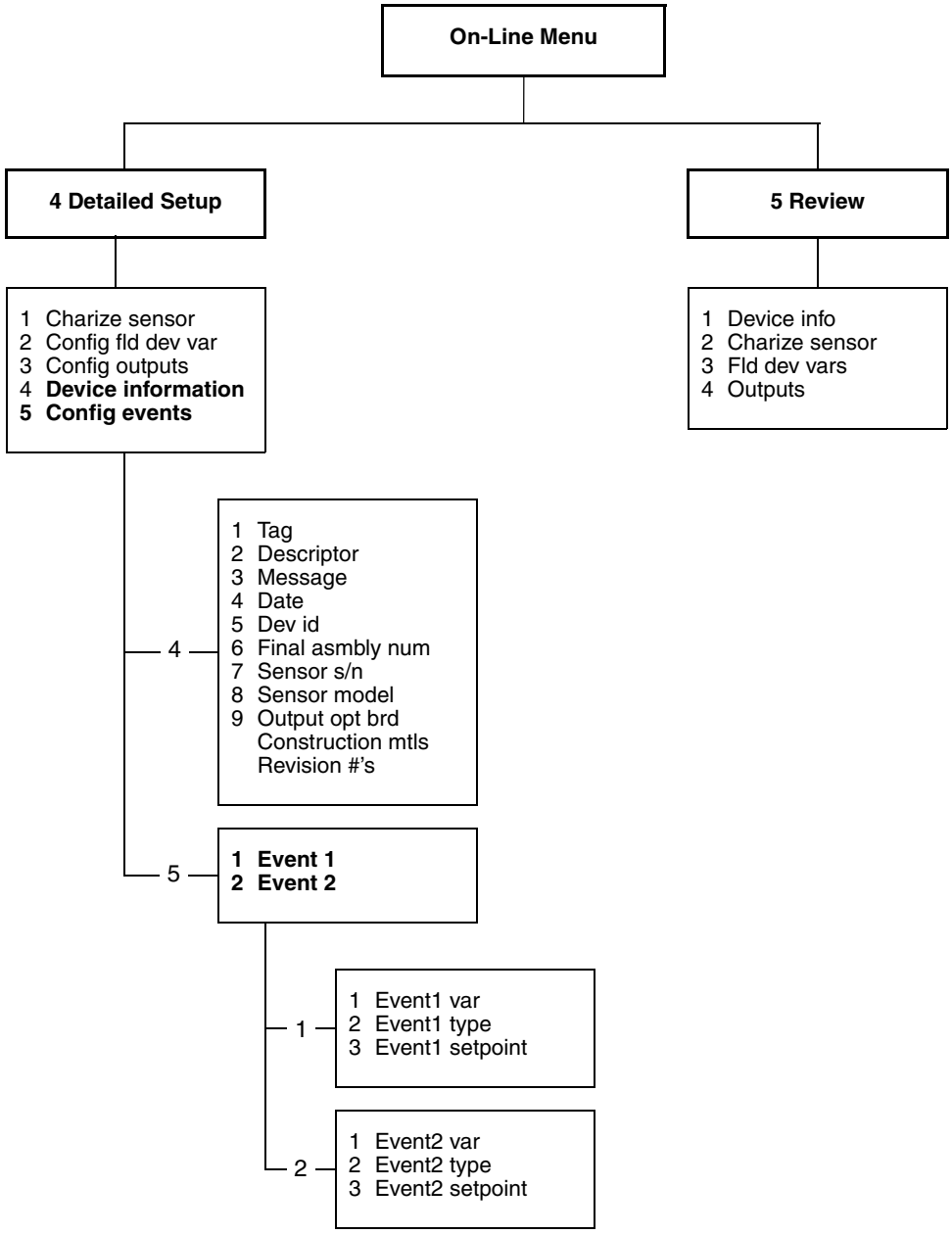
(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

Figure F-7 Communicator menus (confined)



(1) As channel configuration options are selected, different options are displayed at lower levels of the menu. Menu numbers are adjusted accordingly. This menu does not show all configuration options.

Figure F-8 Communicator menus (confined)



Appendix G
Menu Flowcharts – Model 1700/2700 AN Transmitters

G.1 Overview

This appendix provides the following menu flowcharts for the Model 1700/2700 AN transmitter:

- ProLink II menus
  - Configuration menu – see Figures G-1 and G-2
  - Operating menus – see Figure G-3
- Communicator menus – see Figures G-4 through G-8
- Display menus
  - Managing totalizers and inventories – see Figure G-9
  - Off-line maintenance menu: Version information – see Figure G-10
  - Off-line maintenance menu: Configuration – see Figures G-11 and G-12
  - Off-line maintenance menu: Simulation (loop testing) – see Figure G-13
  - Off-line maintenance menu: Zero – see Figure G-14

  For information on the codes and abbreviations used on the display, see Appendix J.

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

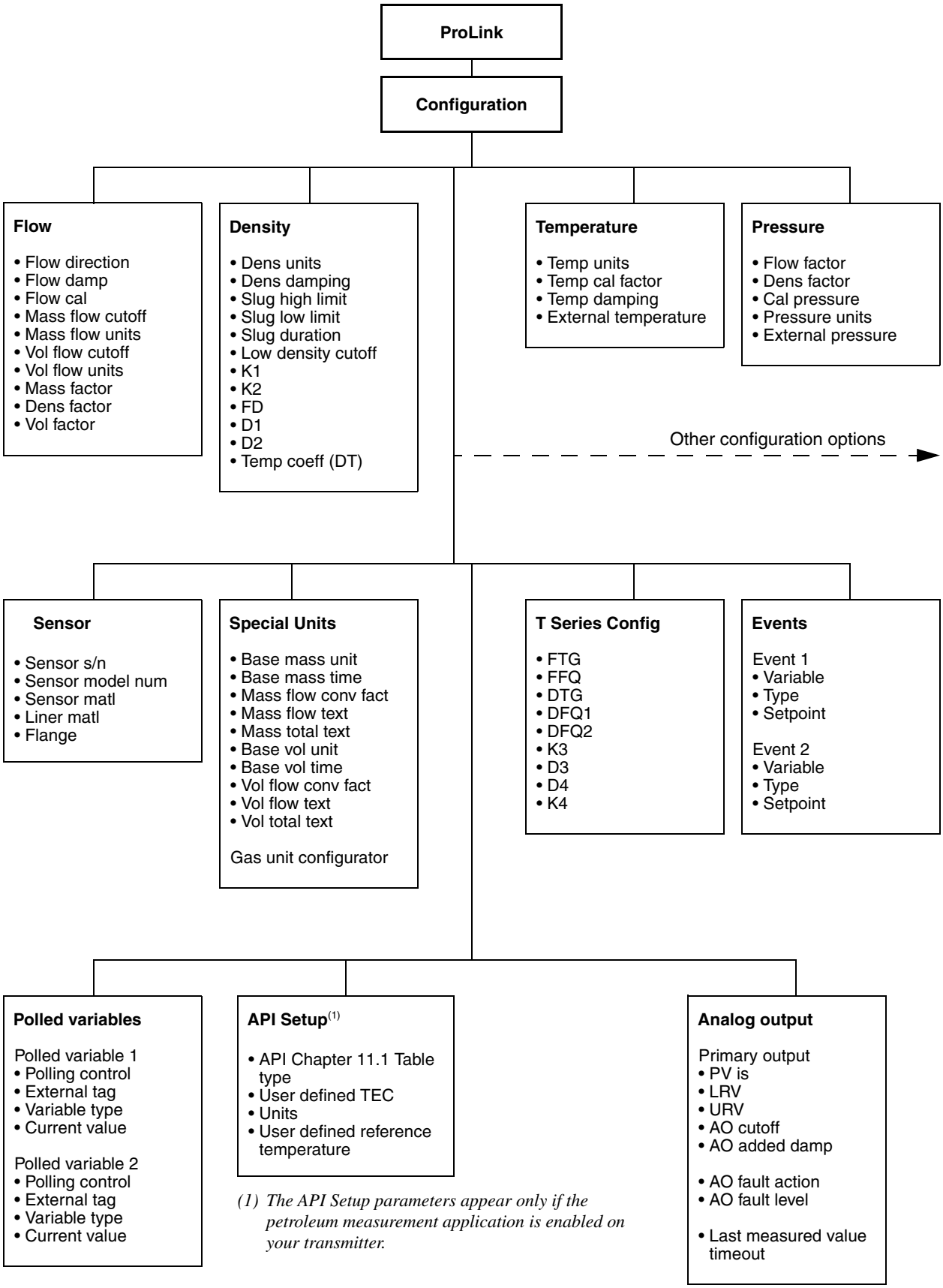
G.2 Version information

These menu flowcharts are based on:

- Transmitter software v3.7
- Core processor software v2.1
- ProLink II v2.1
- 275 HART Communicator device rev3, DD rev1

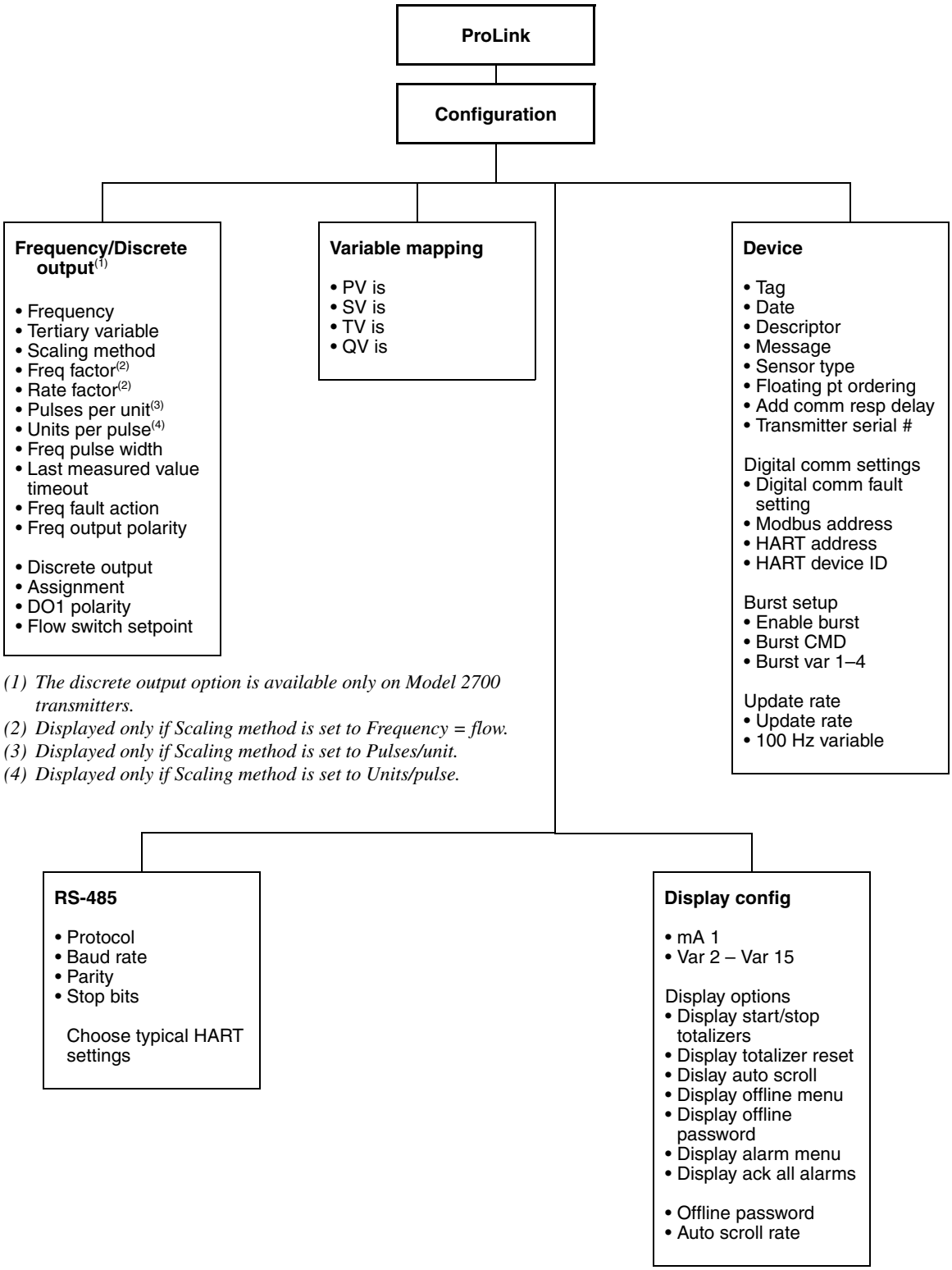
Menus may vary slightly for different versions of these components.

Figure G-1 ProLink II configuration menu



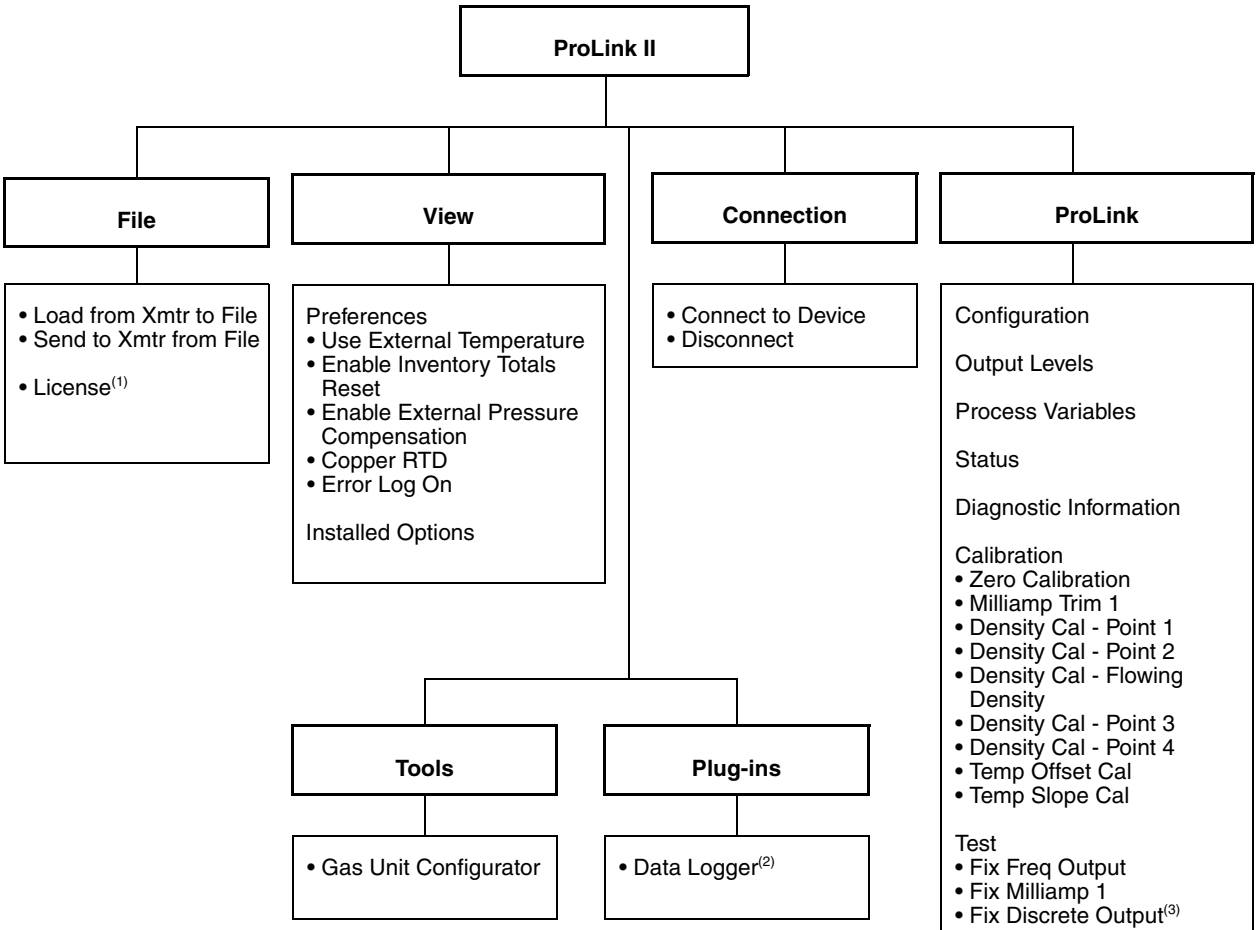
(1) The API Setup parameters appear only if the petroleum measurement application is enabled on your transmitter.

Figure G-2 ProLink II configuration menu (continued)



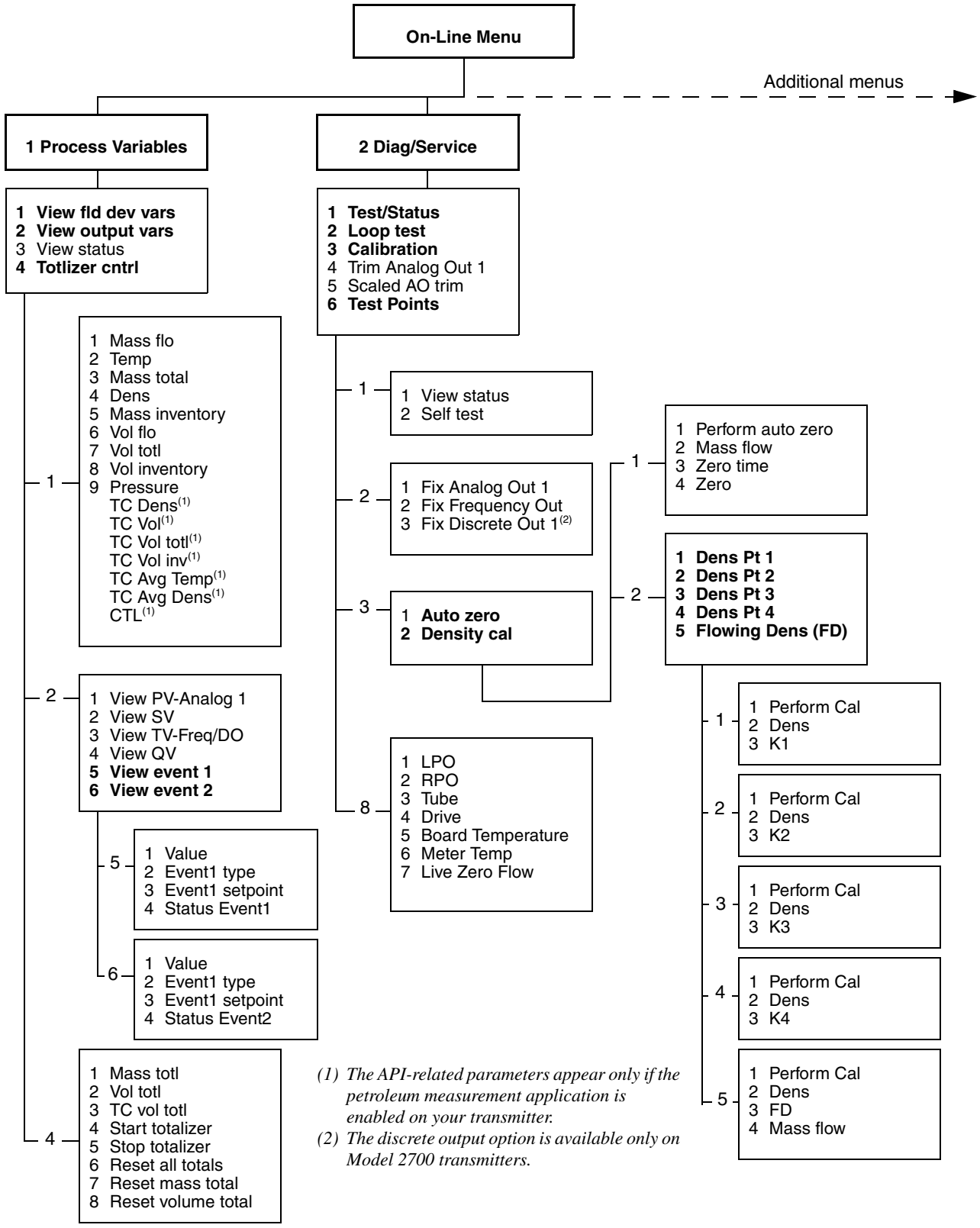
(1) The discrete output option is available only on Model 2700 transmitters.
(2) Displayed only if Scaling method is set to Frequency = flow.
(3) Displayed only if Scaling method is set to Pulses/unit.
(4) Displayed only if Scaling method is set to Units/pulse.

Figure G-3 ProLink II operating menus



(1) The licensing feature is not available on all versions of ProLink II.
(2) For information about using Data Logger, see the ProLink II manual.
(3) The discrete output test is available only on Model 2700 transmitters.
(4) The Reset inventories option is available only if it has been enabled in the ProLink II Preferences menu.

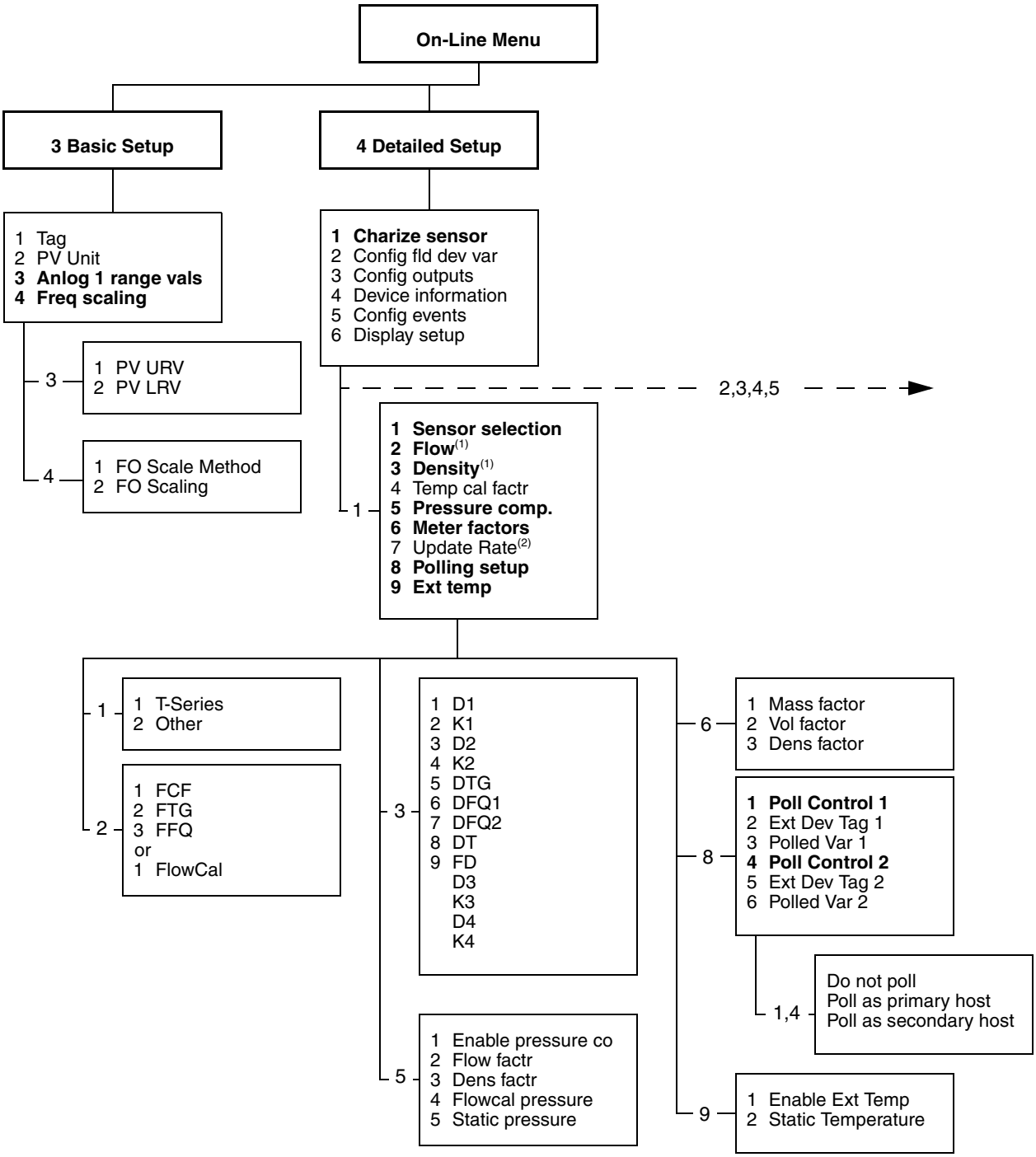
Figure G-4 Communicator menus



(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

(2) The discrete output option is available only on Model 2700 transmitters.

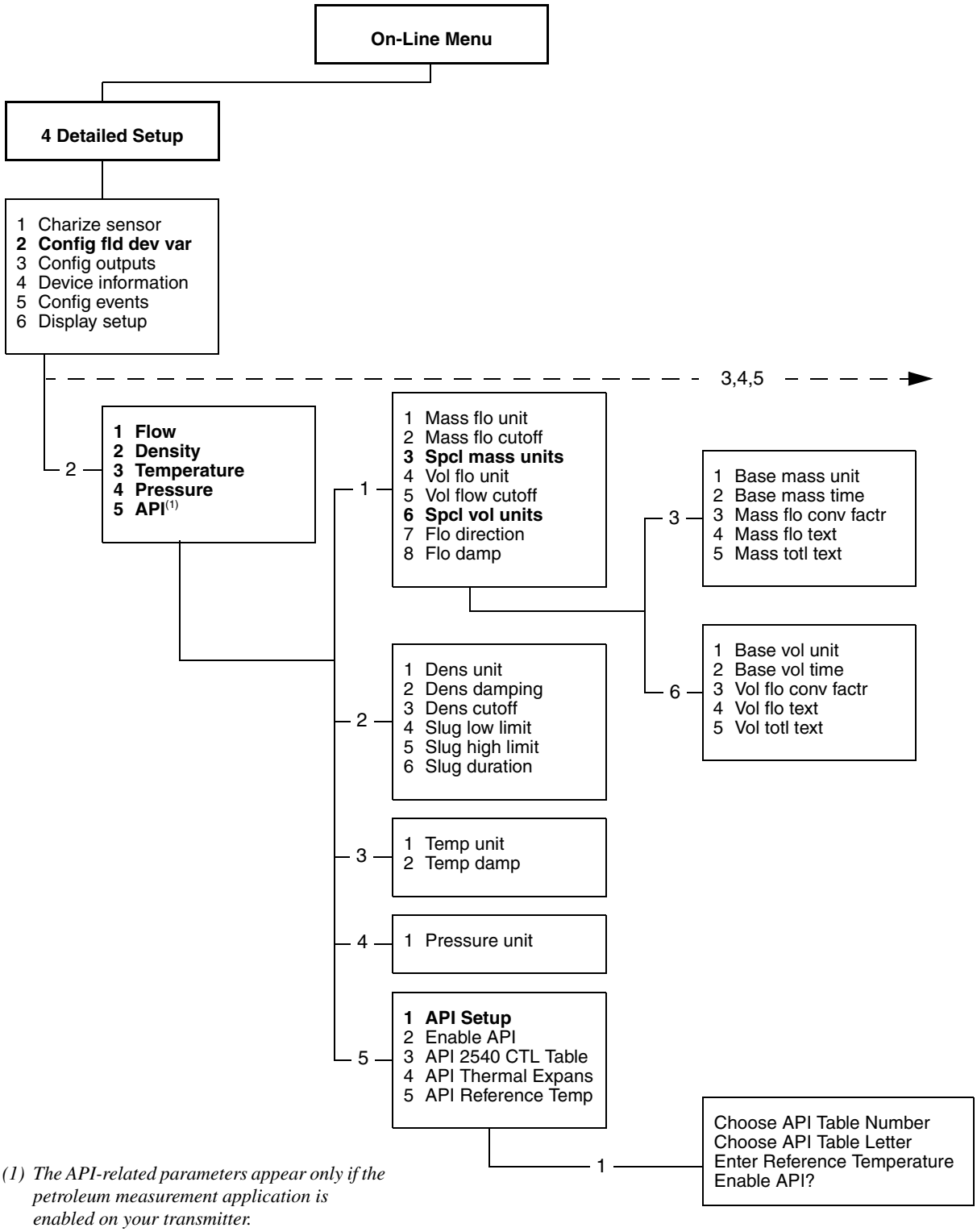
Figure G-5 Communicator menus (confined)



(1) Different flow and density parameters are displayed depending on your sensor selection. Menu numbers are adjusted accordingly. For more information, see Section 6.2.

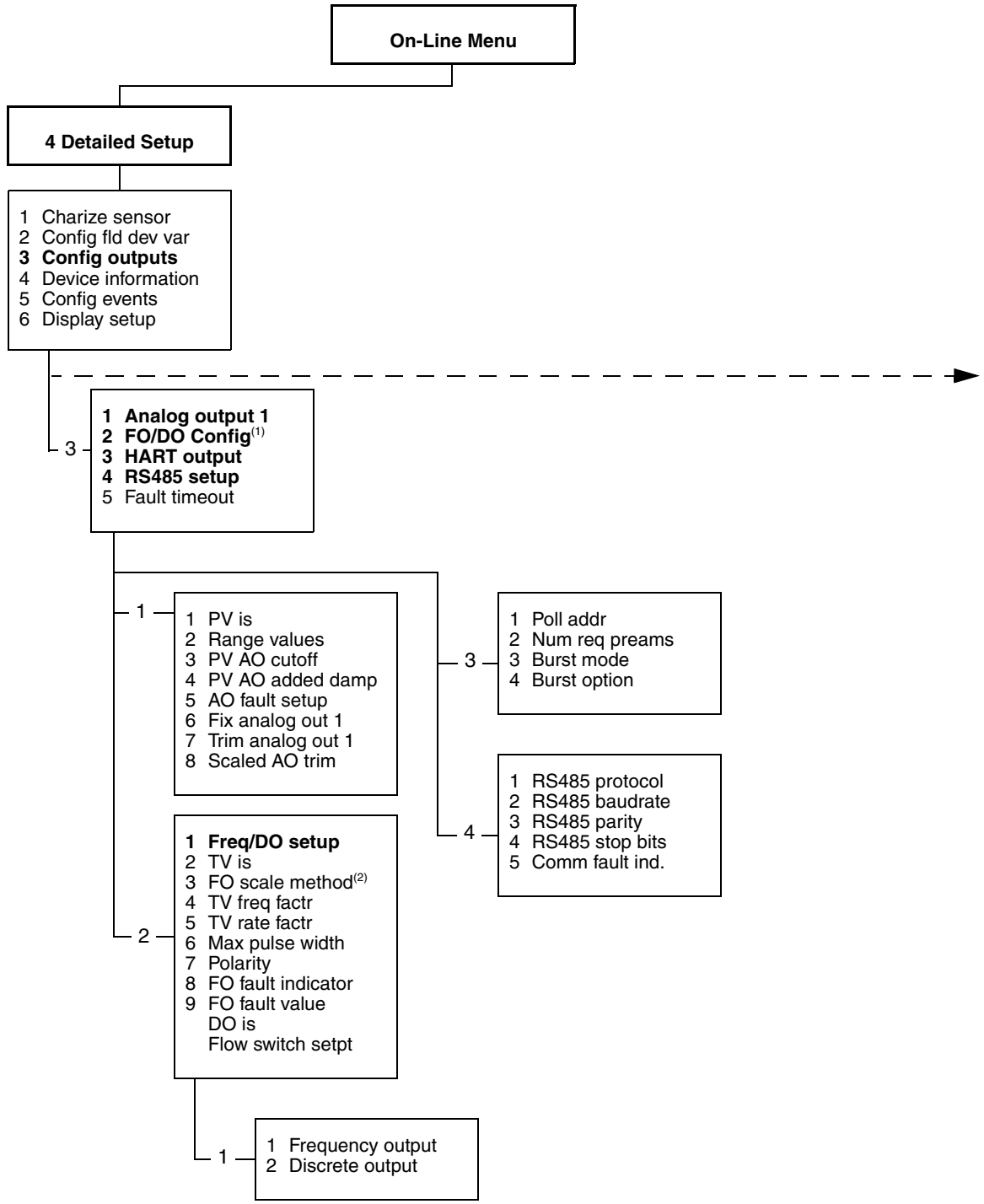
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.

Figure G-6 Communicator menus (continued)



(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

Figure G-7 Communicator menus (confined)



(1) The discrete output options are available only on Model 2700 transmitters.

(2) Different frequency output parameters are displayed depending on the scaling method selected.

Figure G-8 Communicator menus (confined)

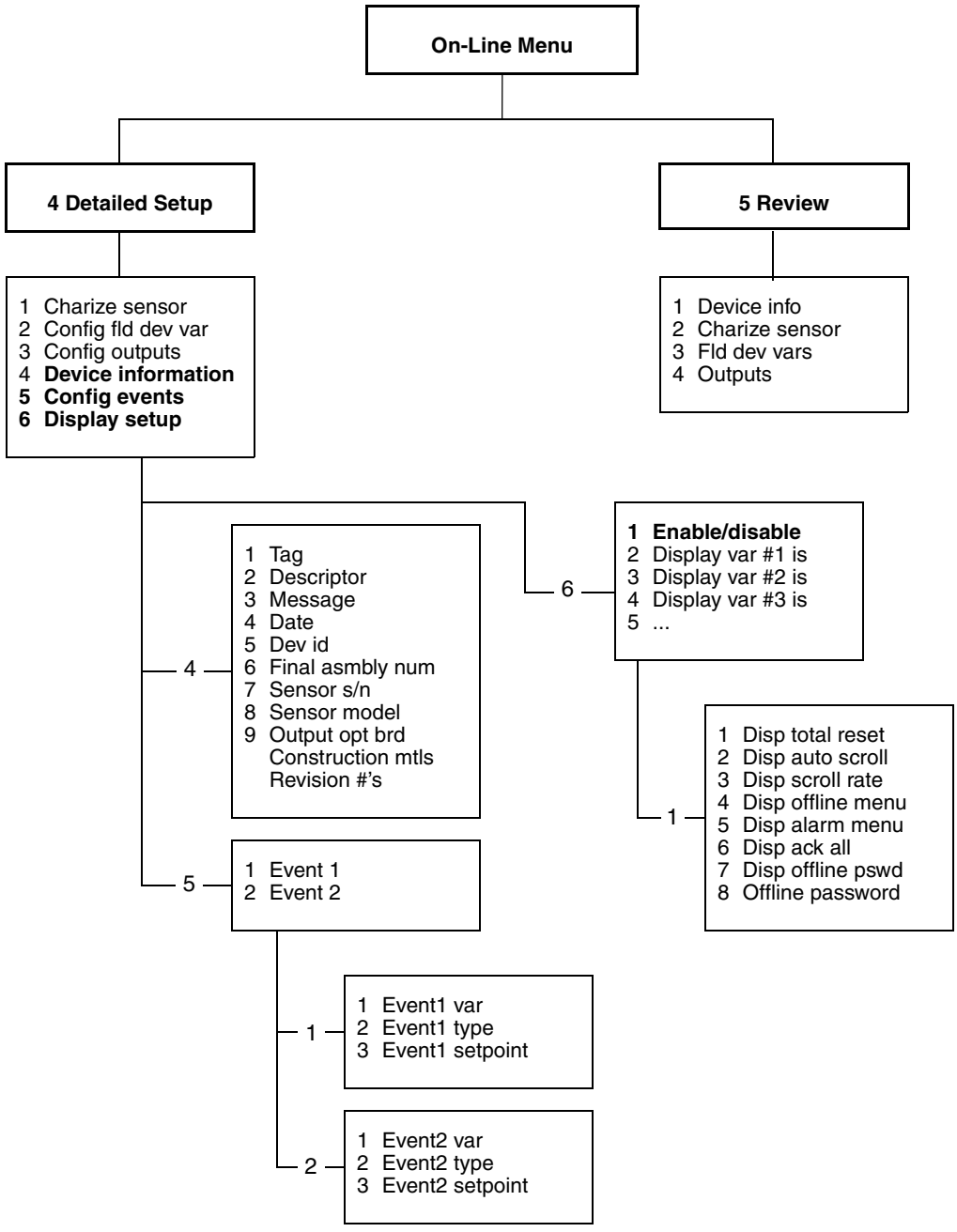
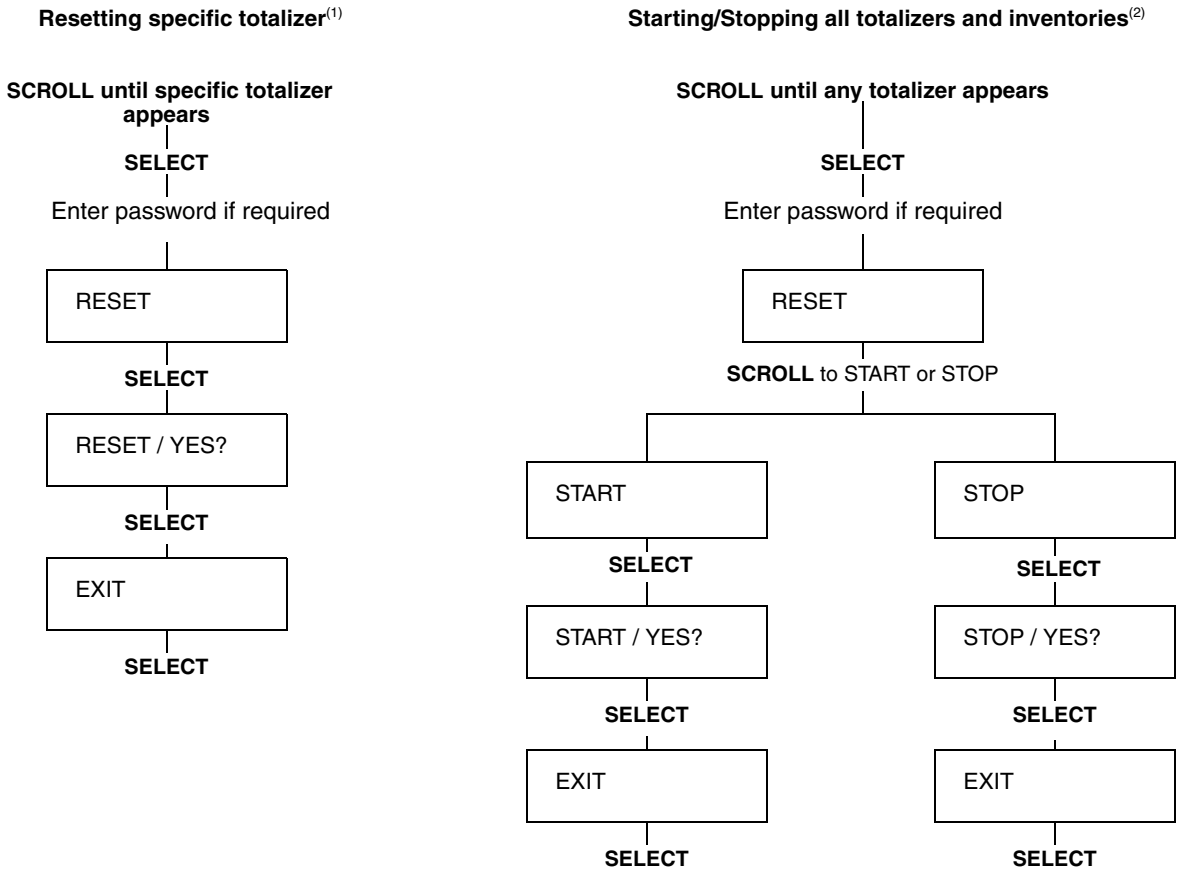


Figure G-9 Display menu – Managing totalizers and inventories



(1) Transmitter must be configured to allow resetting totalizers from display. See Section 8.14.1.
(2) Transmitter must be configured to allow starting and stopping totalizers from display. See Section 8.14.1.

Figure G-10 Display menu – Maintenance – Version information

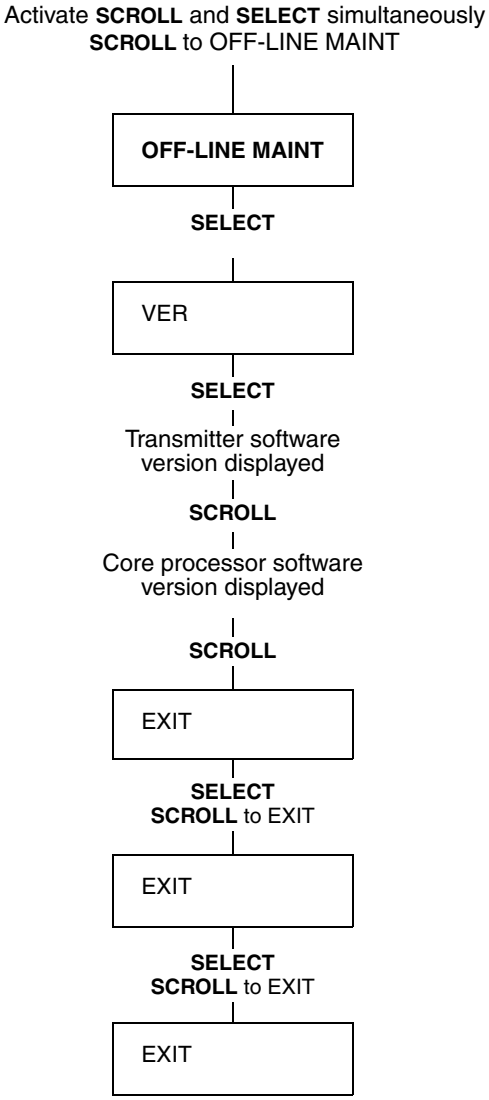
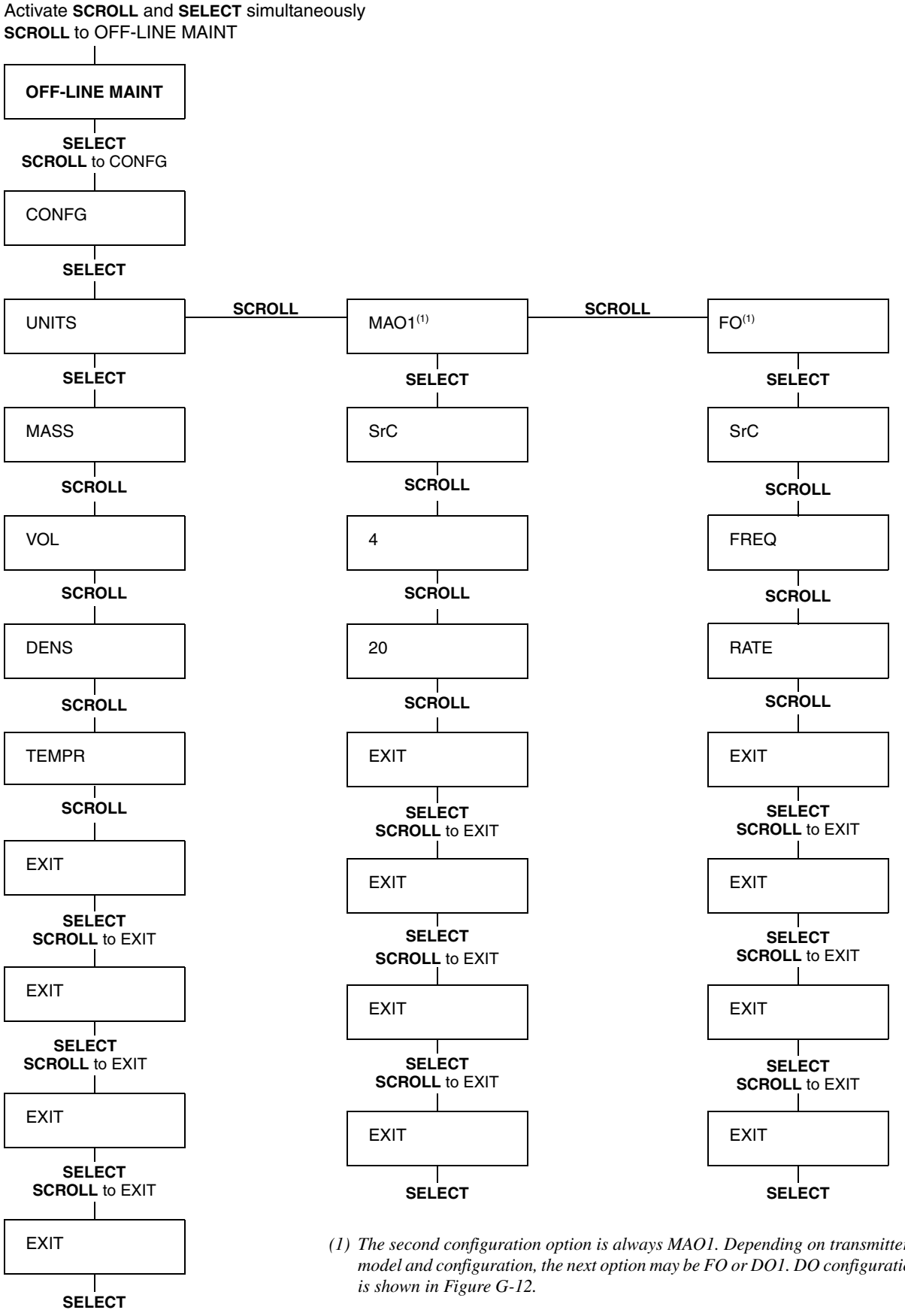
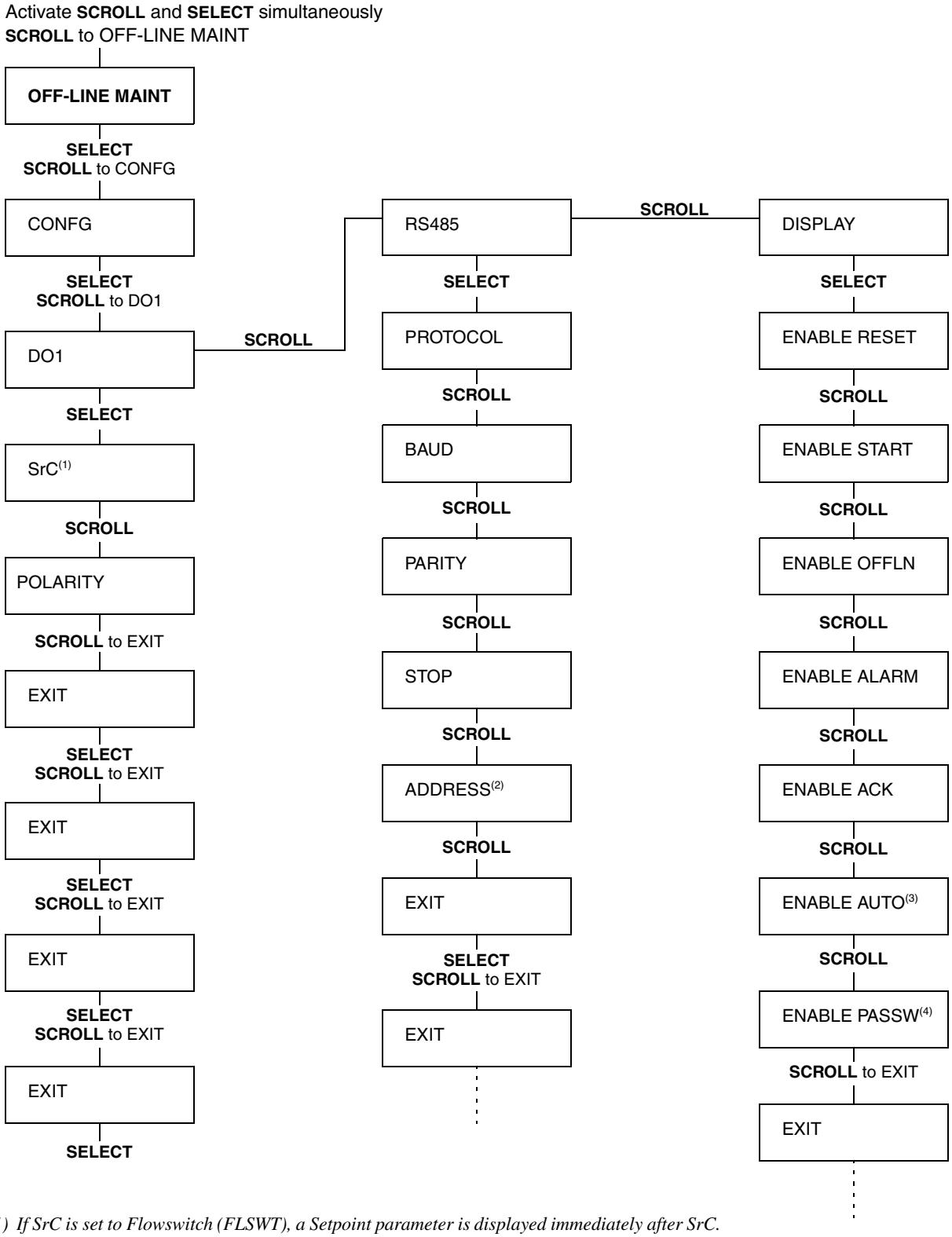


Figure G-11 Display menu – Maintenance – Configuration: Units, mA output, frequency output



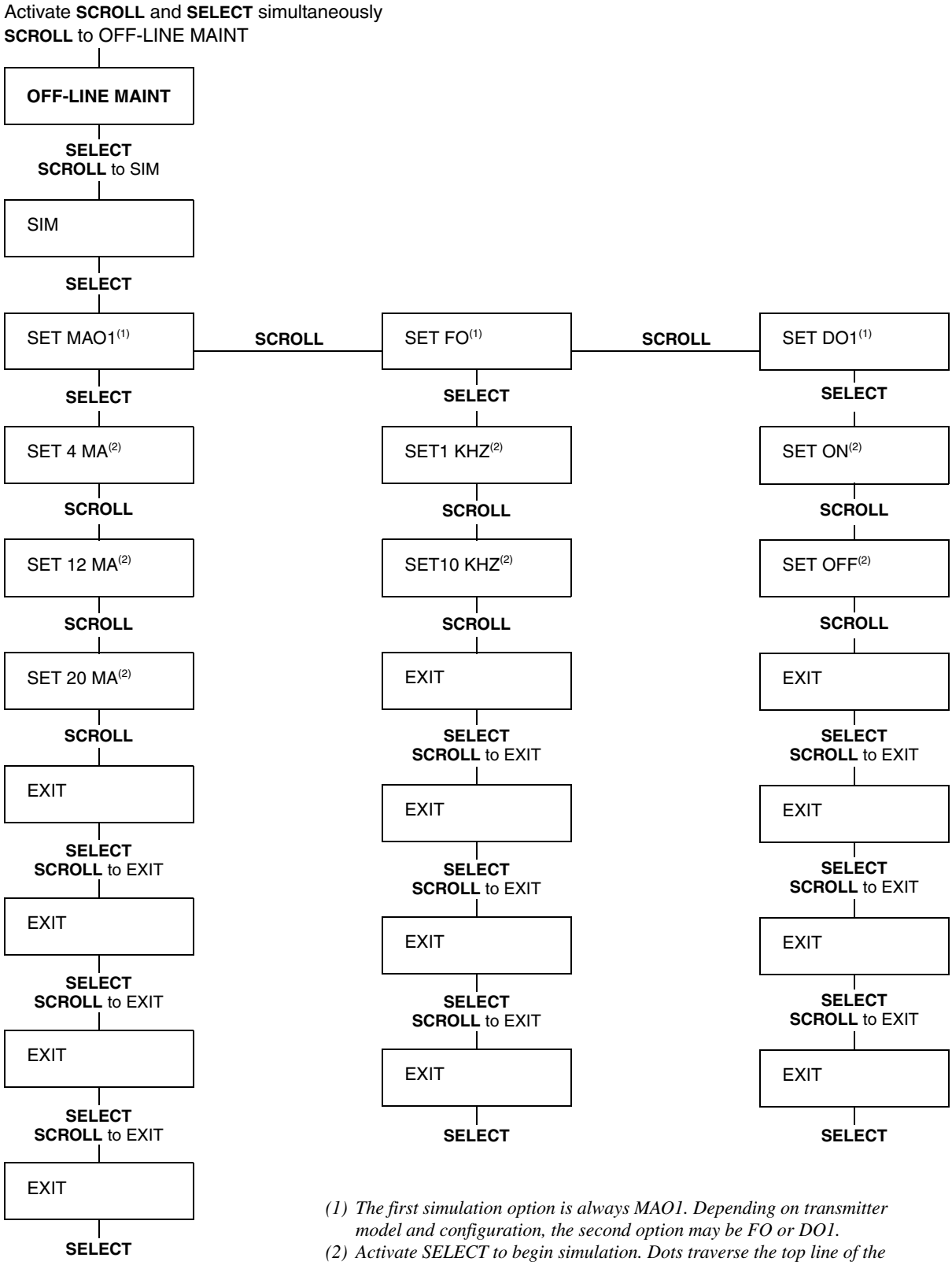
(1) The second configuration option is always MAO1. Depending on transmitter model and configuration, the next option may be FO or DO1. DO configuration is shown in Figure G-12.

Figure G-12 Display menu – Maintenance – Configuration: Discrete output, RS-485 comm, display



(1) If SrC is set to Flowswitch (FLSWT), a Setpoint parameter is displayed immediately after SrC.
(2) May be HART address or Modbus address (MBUS), depending on protocol selection.
(3) If Autoscroll is enabled, a Scroll rate parameter is displayed immediately after Enable Auto.
(4) If Password is enabled, a Change Password parameter is displayed immediagely after Enable Passw.

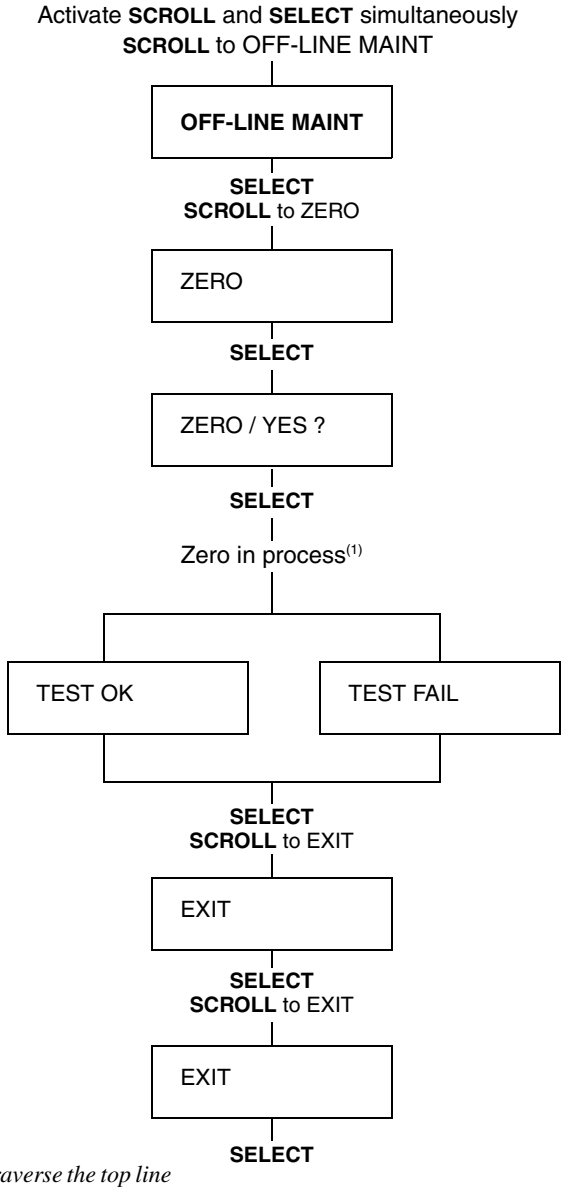
Figure G-13 Display menu – Simulation (loop testing)



(1) The first simulation option is always MAO1. Depending on transmitter model and configuration, the second option may be FO or DO1.

(2) Activate SELECT to begin simulation. Dots traverse the top line of the display while simulation is in process. To end simulation, activate SELECT again.

Figure G-14 Display menu – Zero



(1) While zero is in process, dots traverse the top line of the display and the status LED flashes yellow.

Appendix H
Menu Flowcharts – Model 1700/2700 IS Transmitters

H.1 Overview

This appendix provides the following menu flowcharts for the Model 1700/2700 IS transmitter:

- ProLink II menus
  - Configuration menu – see Figures H-1 and H-2
  - Operating menus – see Figure H-3
- Communicator menus – see Figures H-4 through H-8
- Display menus
  - Managing totalizers and inventories – see Figure H-9
  - Off-line maintenance menu: Version information – see Figure H-10
  - Off-line maintenance menu: Configuration – see Figures H-11 and H-12
  - Off-line maintenance menu: Simulation (loop testing) – see Figure H-13
  - Off-line maintenance menu: Zero – see Figure H-14

  For information on the codes and abbreviations used on the display, see Appendix J.

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

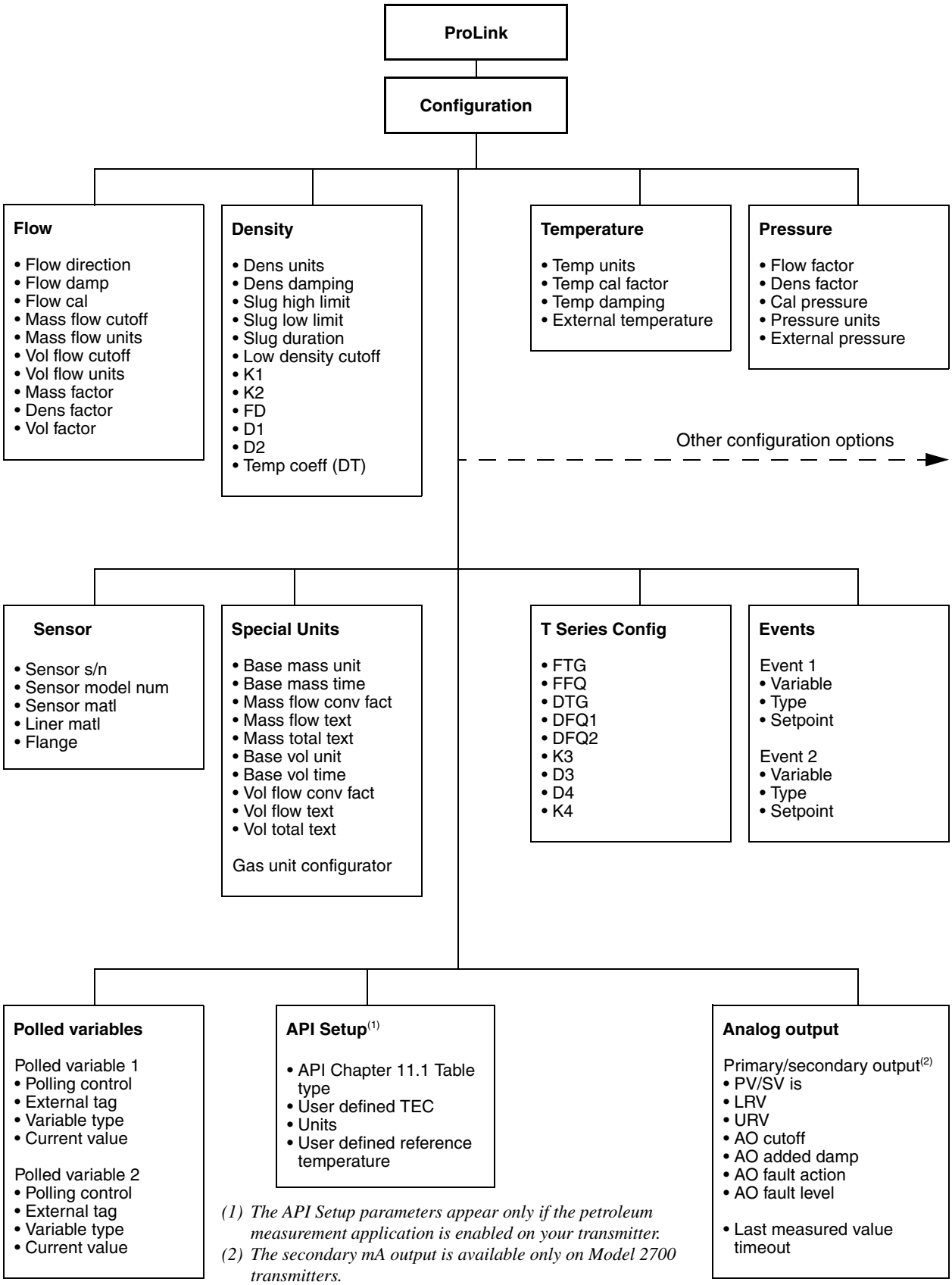
H.2 Version information

These menu flowcharts are based on:

- Transmitter software v3.7
- Core processor software v2.1
- ProLink II v2.1
- 275 HART Communicator device rev3, DD rev1

Menus may vary slightly for different versions of these components.

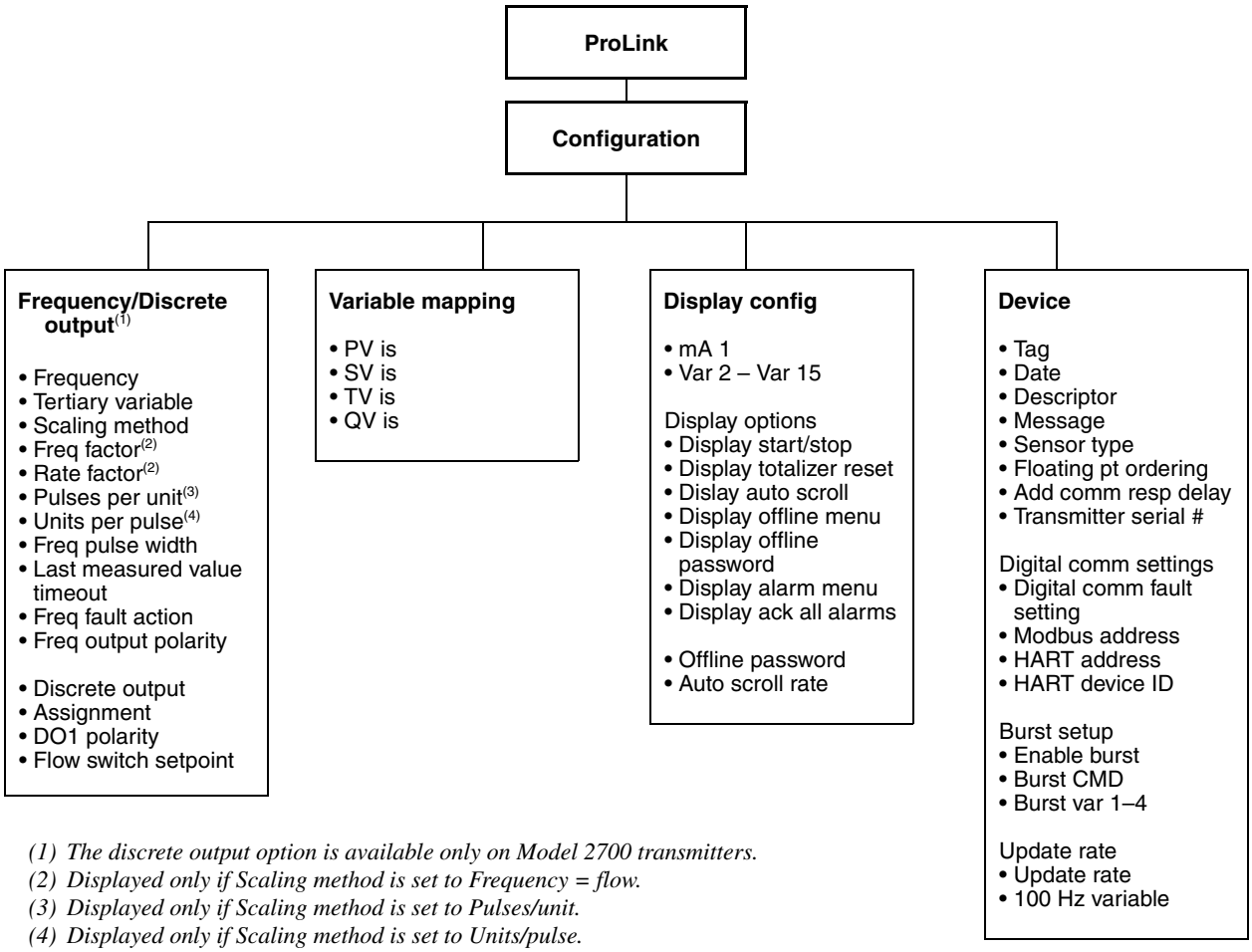
Figure H-1 ProLink II configuration menu



(1) The API Setup parameters appear only if the petroleum measurement application is enabled on your transmitter.

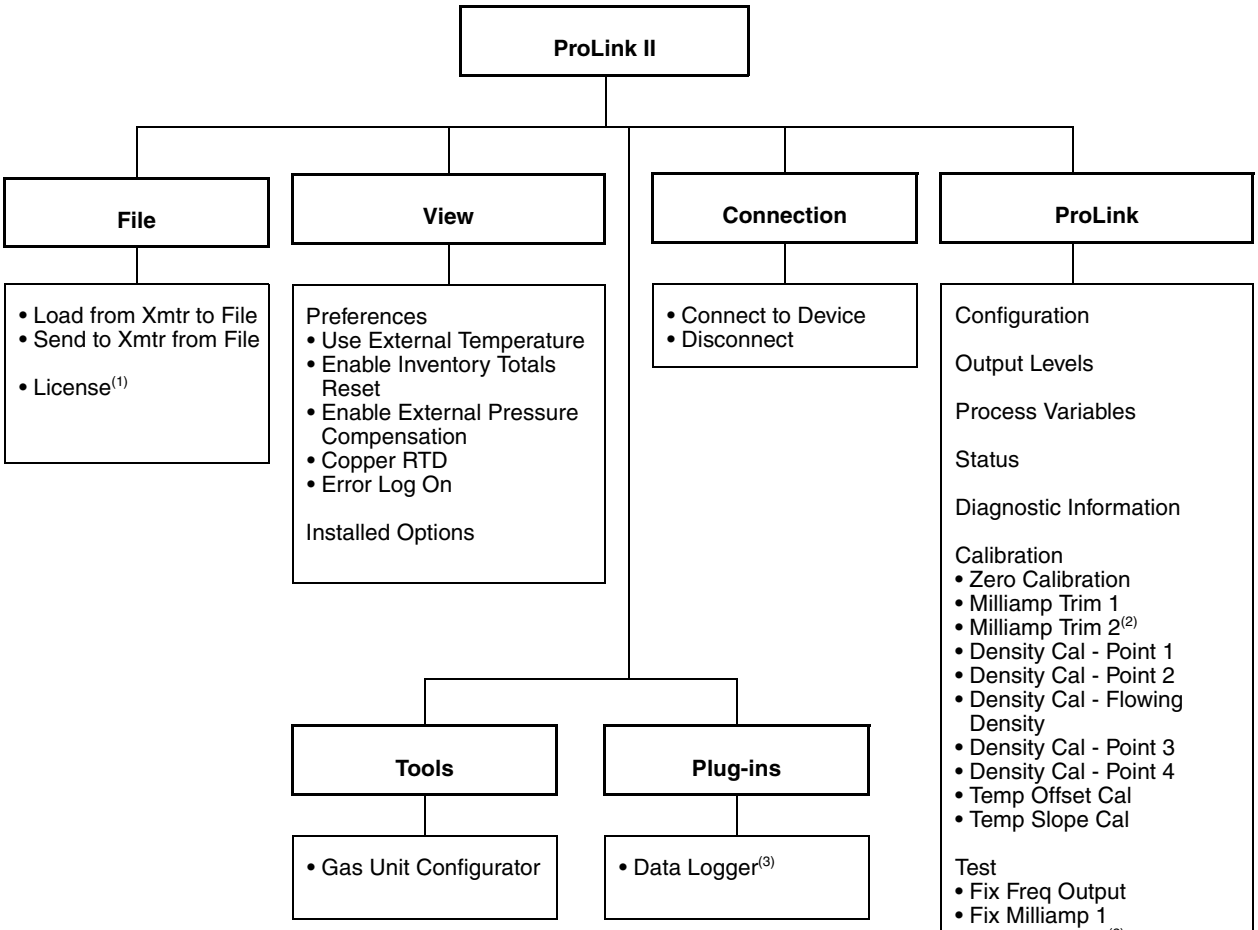
(2) The secondary mA output is available only on Model 2700 transmitters.

Figure H-2 ProLink II configuration menu (continued)



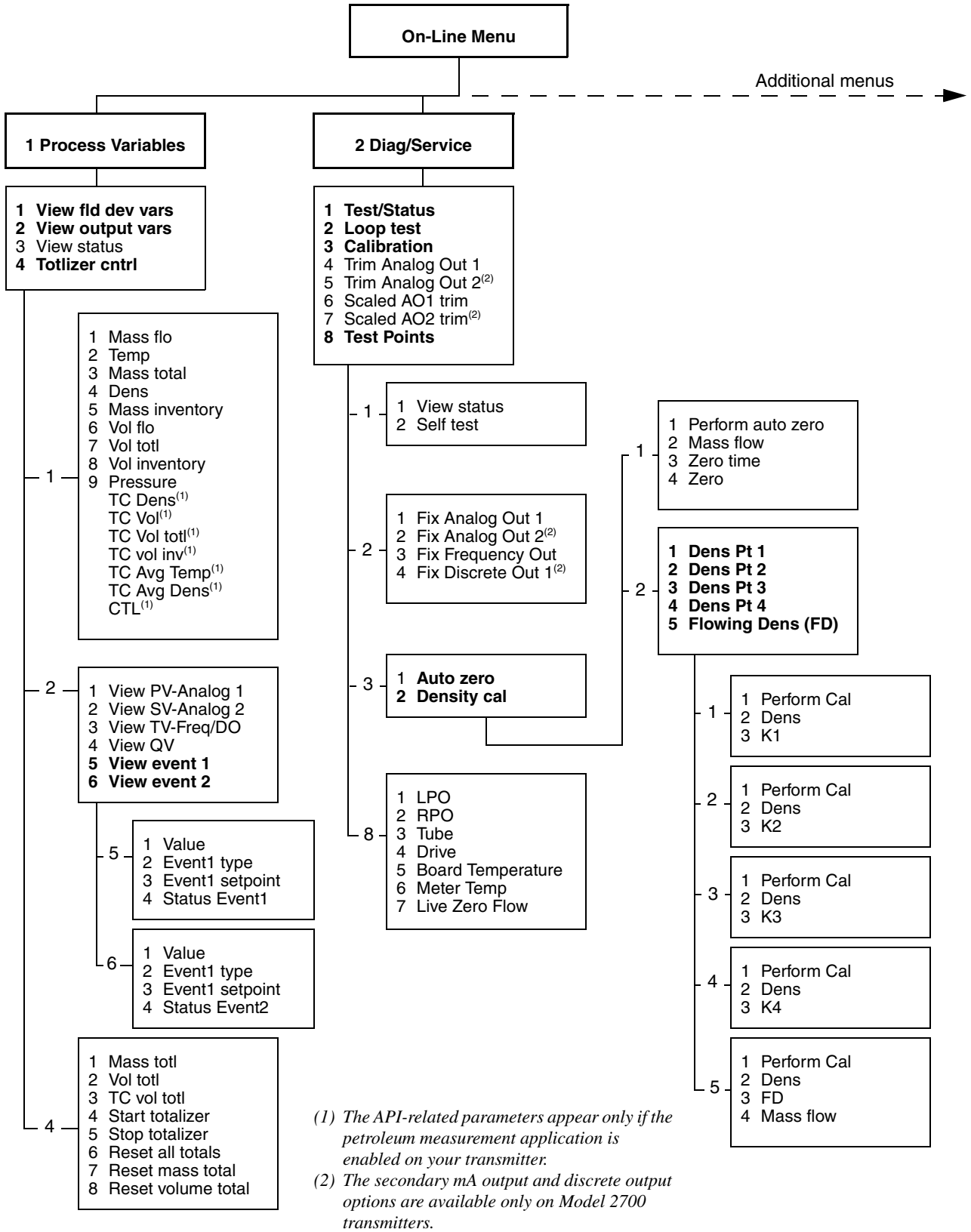
(1) The discrete output option is available only on Model 2700 transmitters.
(2) Displayed only if Scaling method is set to Frequency = flow.
(3) Displayed only if Scaling method is set to Pulses/unit.
(4) Displayed only if Scaling method is set to Units/pulse.

Figure H-3 ProLink II operating menus



(1) The licensing feature is not available on all versions of ProLink II.
(2) The secondary mA output and discrete output options are available only on Model 2700 transmitters.
(3) For information about using Data Logger, see the ProLink II manual.
(4) The Reset inventories option is available only if it has been enabled in the ProLink II Preferences menu.

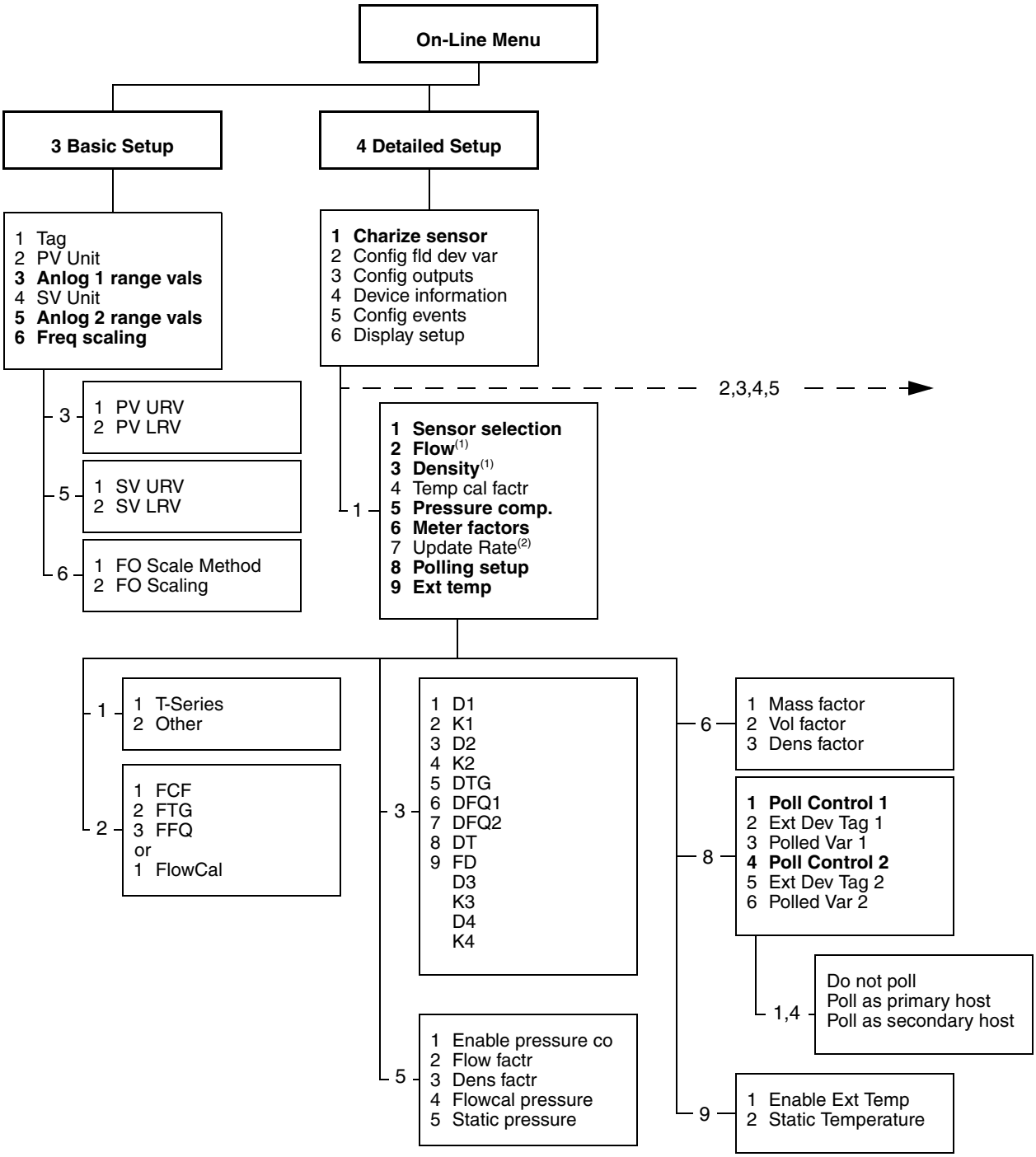
Figure H-4 Communicator menus



(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

(2) The secondary mA output and discrete output options are available only on Model 2700 transmitters.

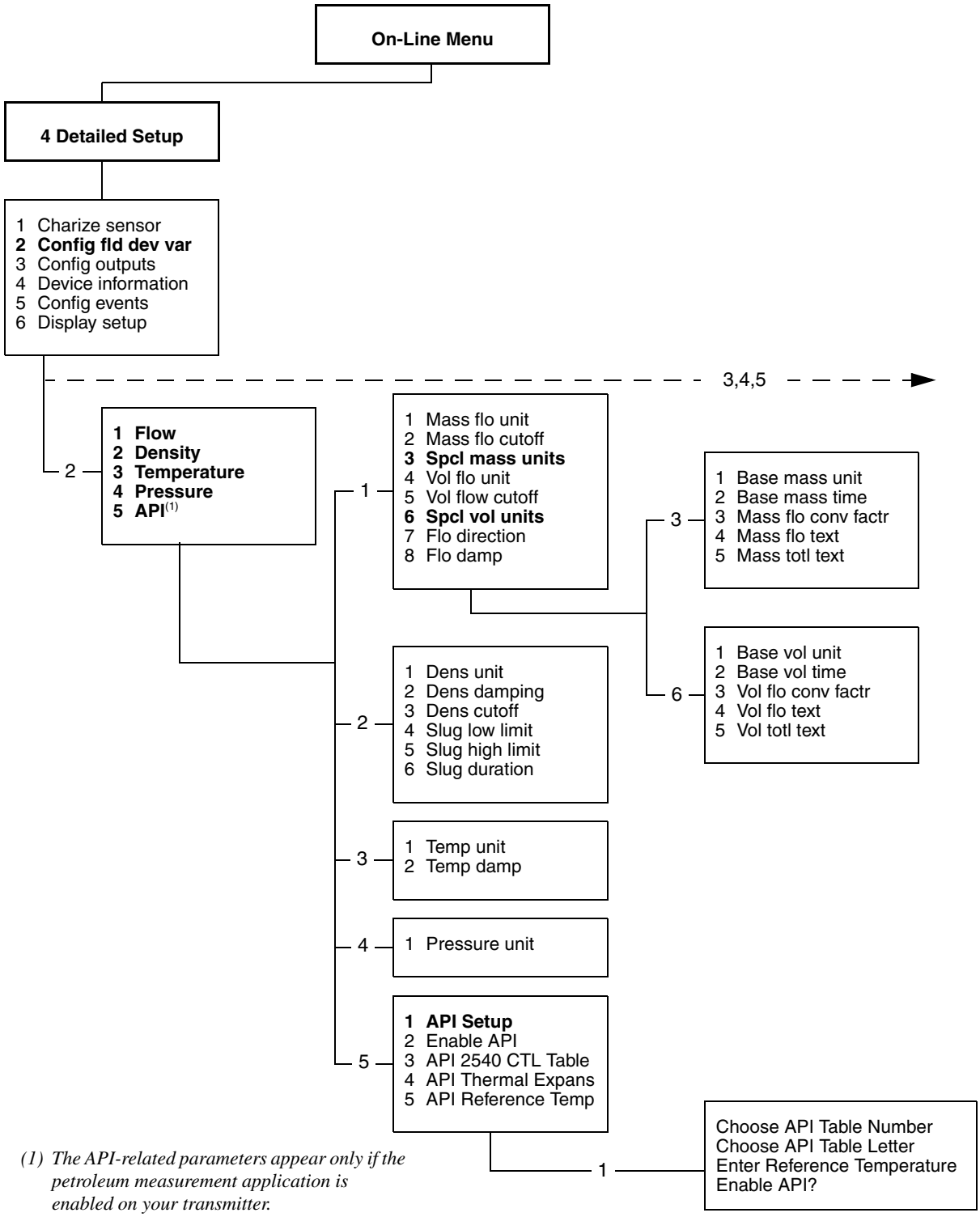
Figure H-5 Communicator menus (confined)



(1) Different flow and density parameters are displayed depending on your sensor selection. Menu numbers are adjusted accordingly. For more information, see Section 6.2.

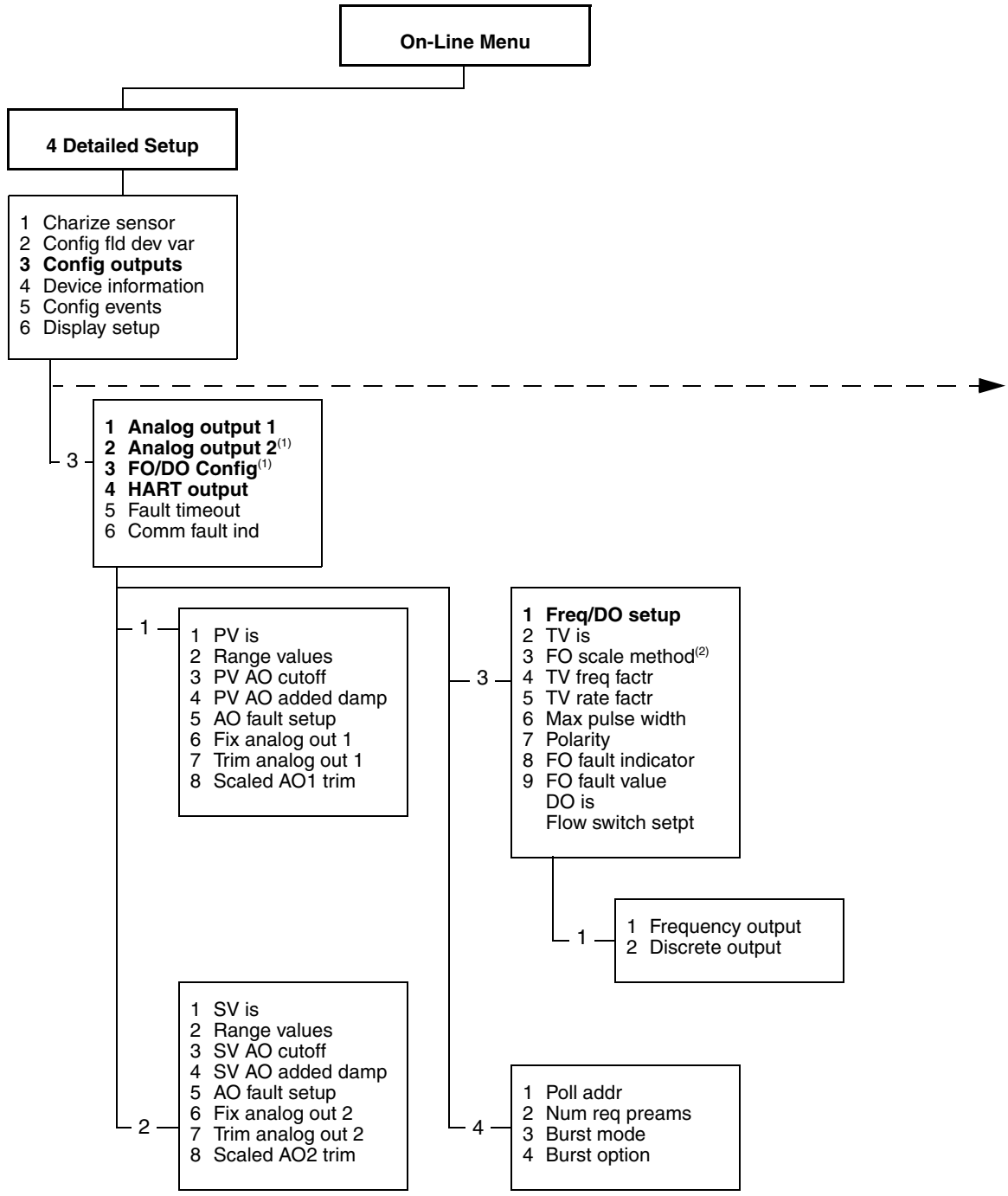
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.

Figure H-6 Communicator menus (continued)



(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

Figure H-7 Communicator menus (confined)



(1) The secondary mA output and discrete output options are available only on Model 2700 transmitters.

(2) Different frequency output parameters are displayed depending on the scaling method selected.

Figure H-8 Communicator menus (confined)

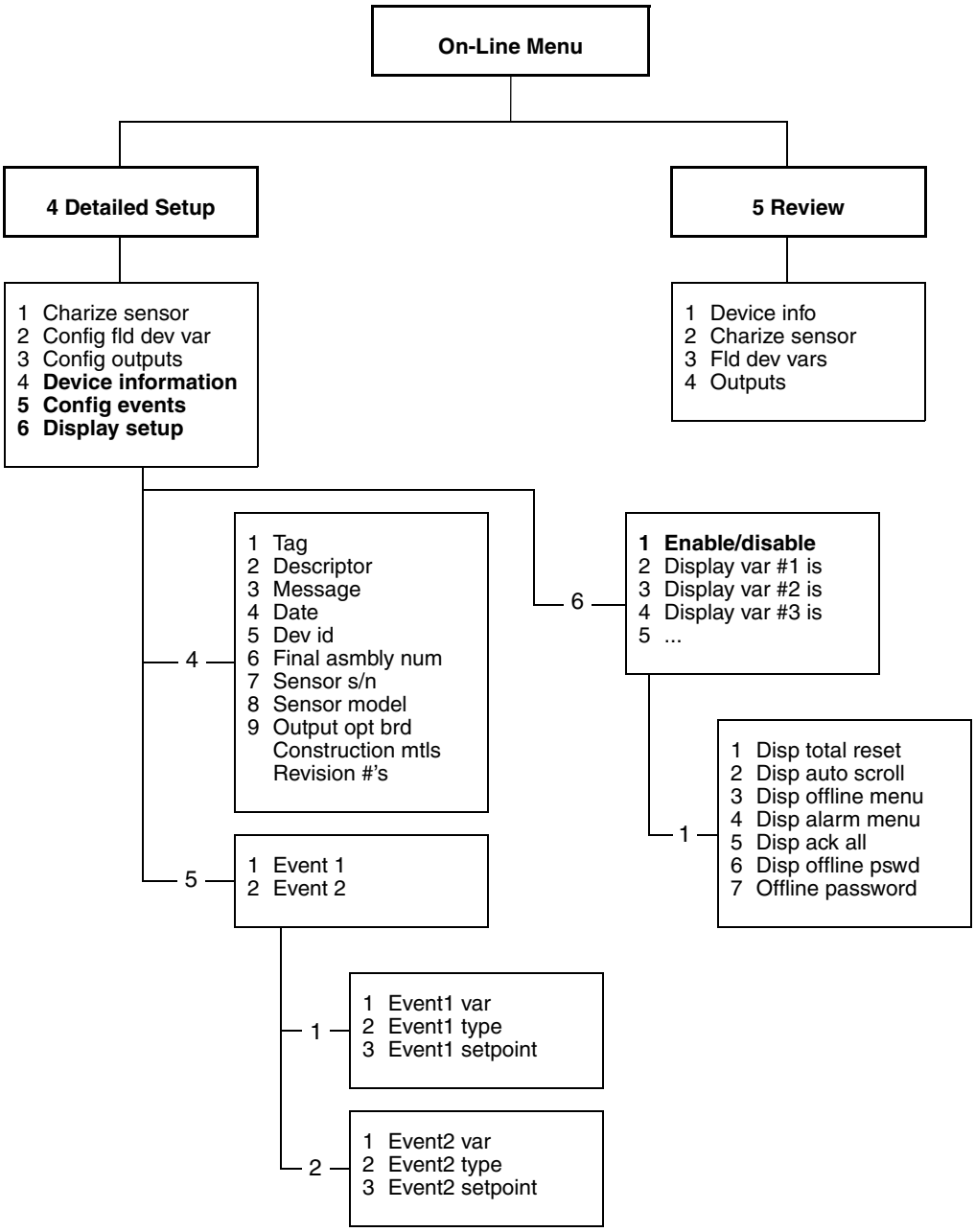
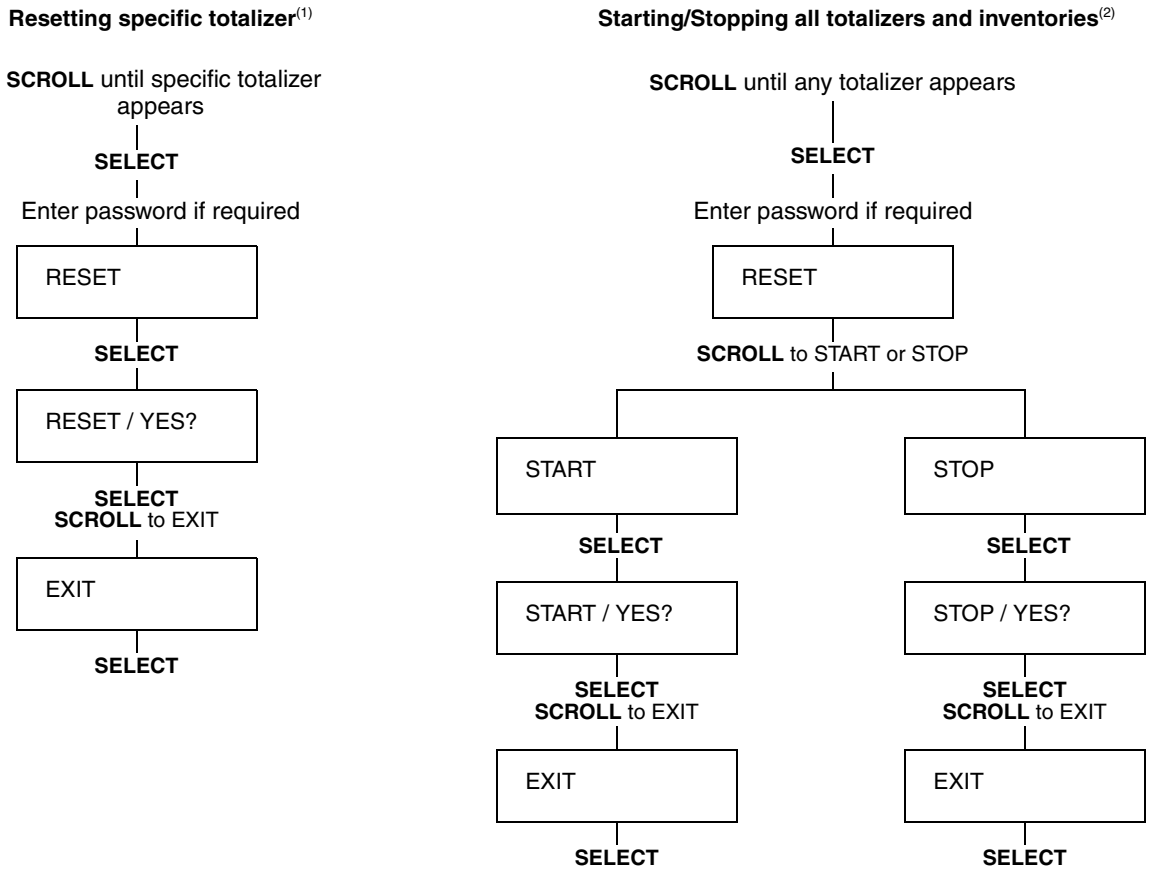


Figure H-9 Display menu – Managing totalizers and inventories



(1) Transmitter must be configured to allow resetting totalizers from display. See Section 8.14.1.
(2) Transmitter must be configured to allow starting and stopping totalizers from display. See Section 8.14.1.

Figure H-10 Display menu – Maintenance – Version information

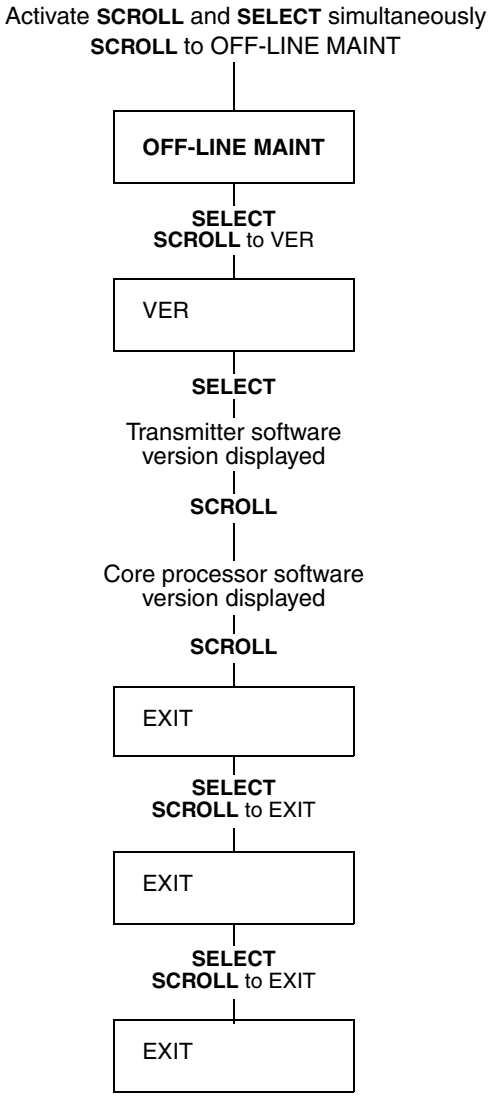
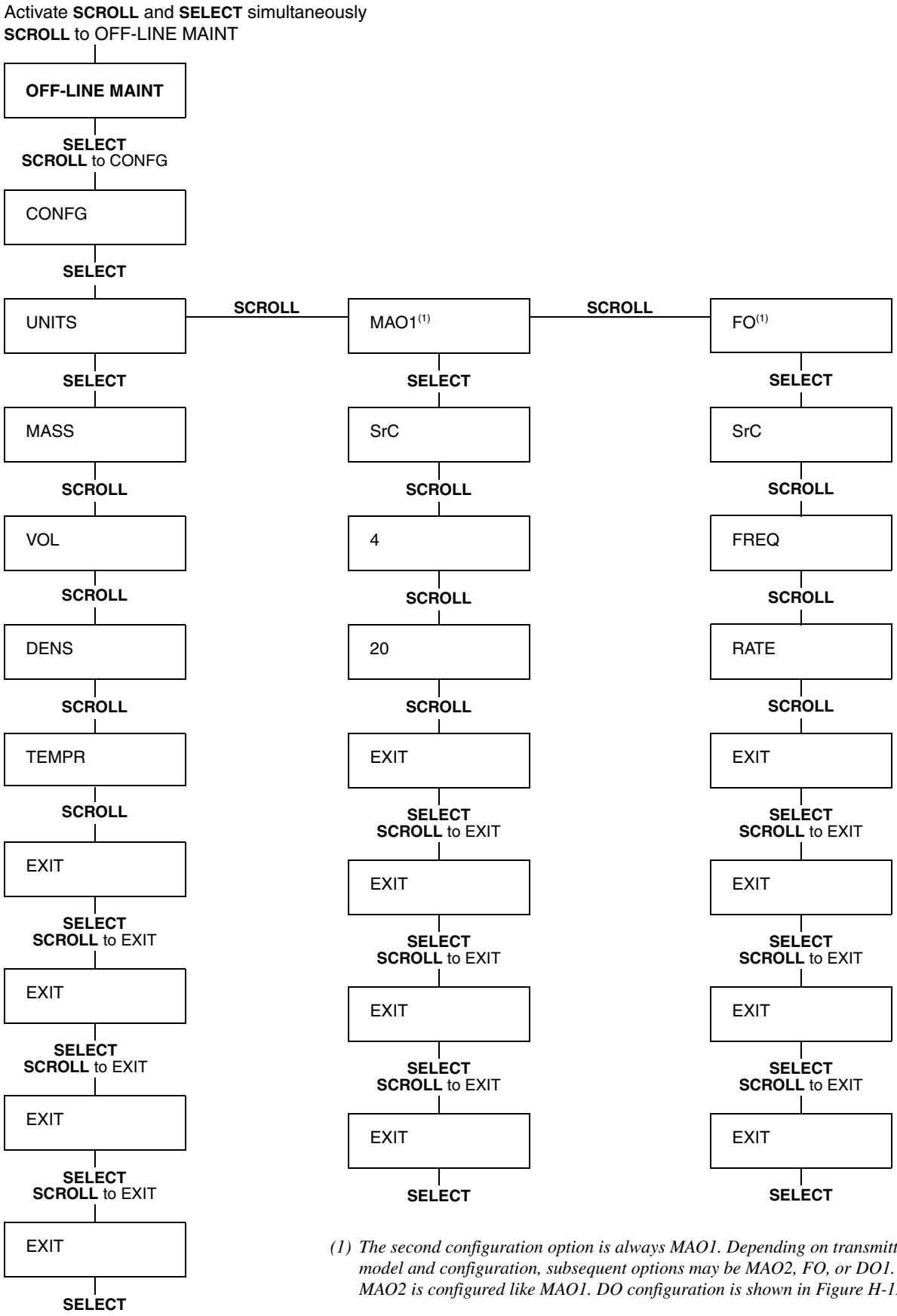
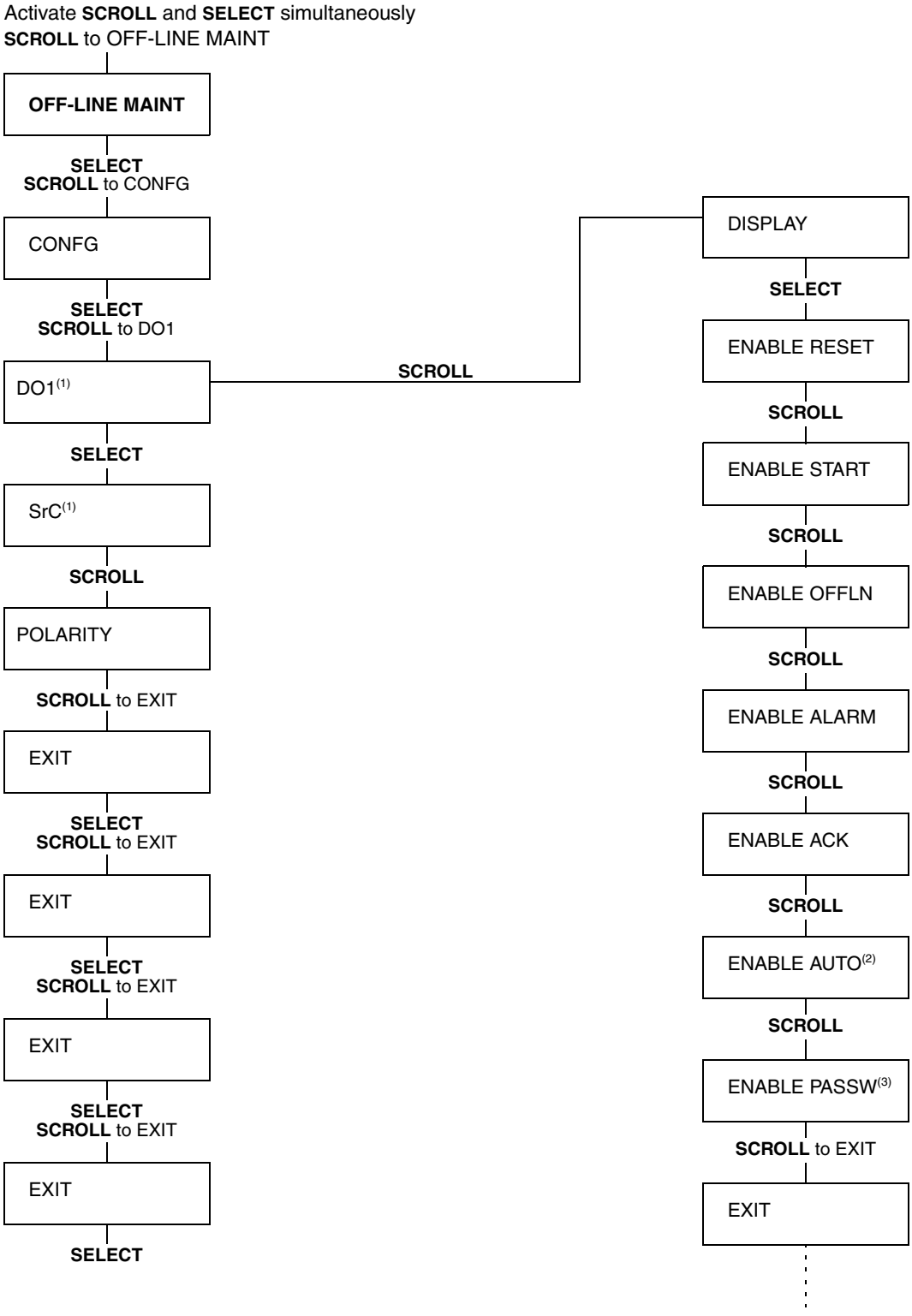


Figure H-11 Display menu – Maintenance – Configuration: Units, mA output(s), frequency output(s)



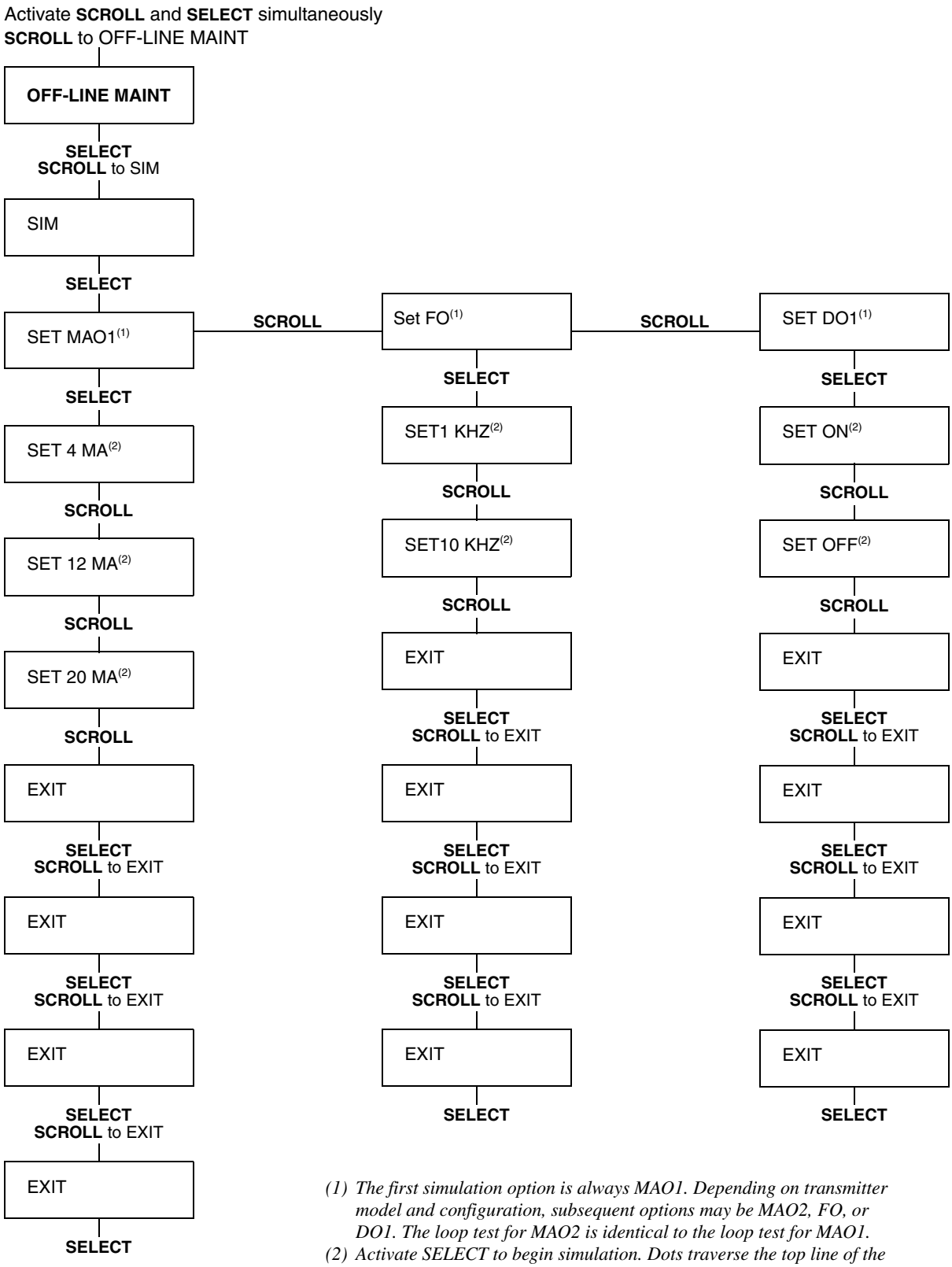
(1) The second configuration option is always MAO1. Depending on transmitter model and configuration, subsequent options may be MAO2, FO, or DO1. MAO2 is configured like MAO1. DO configuration is shown in Figure H-12.

Figure H-12 Display menu – Maintenance – Configuration: Discrete output, display



(1) If SrC is set to Flowswitch (FLSWT), a Setpoint parameter is displayed immediately after SrC.
(2) If Autoscroll is enabled, a Scroll rate parameter is displayed immediately after Enable Auto.
(3) If Password is enabled, a Change Password parameter is displayed immediagely after Enable Passw.

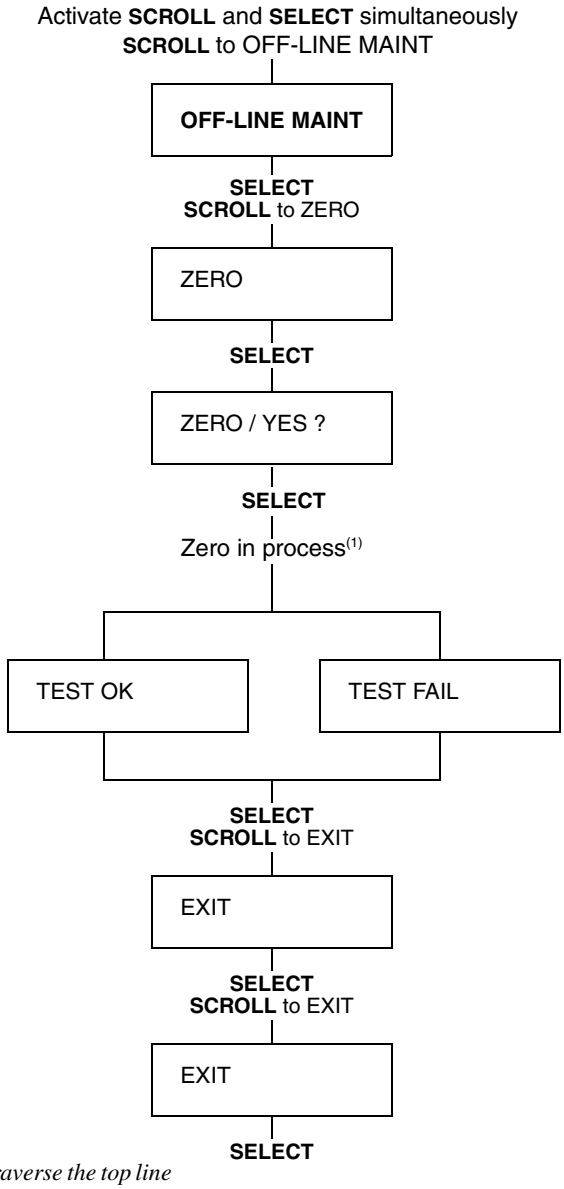
Figure H-13 Display menu – Simulation (loop testing)



(1) The first simulation option is always MAO1. Depending on transmitter model and configuration, subsequent options may be MAO2, FO, or DO1. The loop test for MAO2 is identical to the loop test for MAO1.

(2) Activate SELECT to begin simulation. Dots traverse the top line of the display while simulation is in process. To end simulation, activate SELECT again.

Figure H-14 Display menu – Zero



(1) While zero is in process, dots traverse the top line of the display and the status LED flashes yellow.

Appendix I
Menu Flowcharts – Model 2700 CIO Transmitters

I.1 Overview

This appendix provides the following menu flowcharts for the Model 2700 CIO transmitter:

- ProLink II menus
  - Configuration menu – see Figures I-1 and I-2
  - Operating menus – see Figure I-3
- Communicator menus – see Figures I-4 through I-8
- Display menus
  - Managing totalizers and inventories – see Figure I-9
  - Off-line maintenance menu: Version information – see Figure I-10
  - Off-line maintenance menu: Configuration – see Figures I-11 and I-12
  - Off-line maintenance menu: Simulation (loop testing) – see Figure I-13
  - Off-line maintenance menu: Zero – see Figure I-14

  For information on the codes and abbreviations used on the display, see Appendix J.

For flowmeter zero, loop testing, and mA output trim procedures, see Chapter 5.

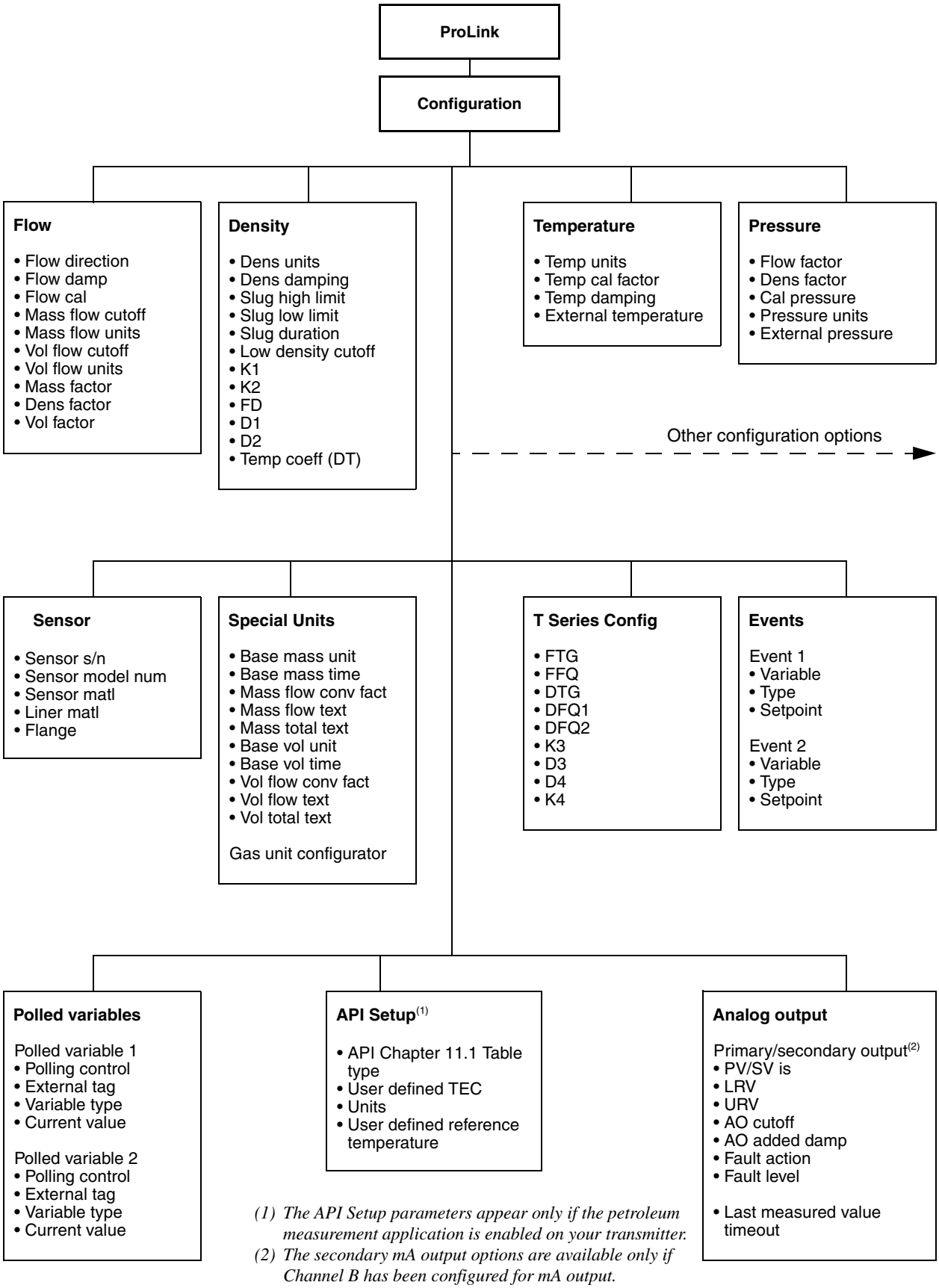
I.2 Version information

These menus flowcharts are based on:

- Transmitter software v4.0
- Core processor software v2.1
- ProLink II v2.1
- 275 HART Communicator device rev3, DD rev1

Menus may vary slightly for different versions of these components.

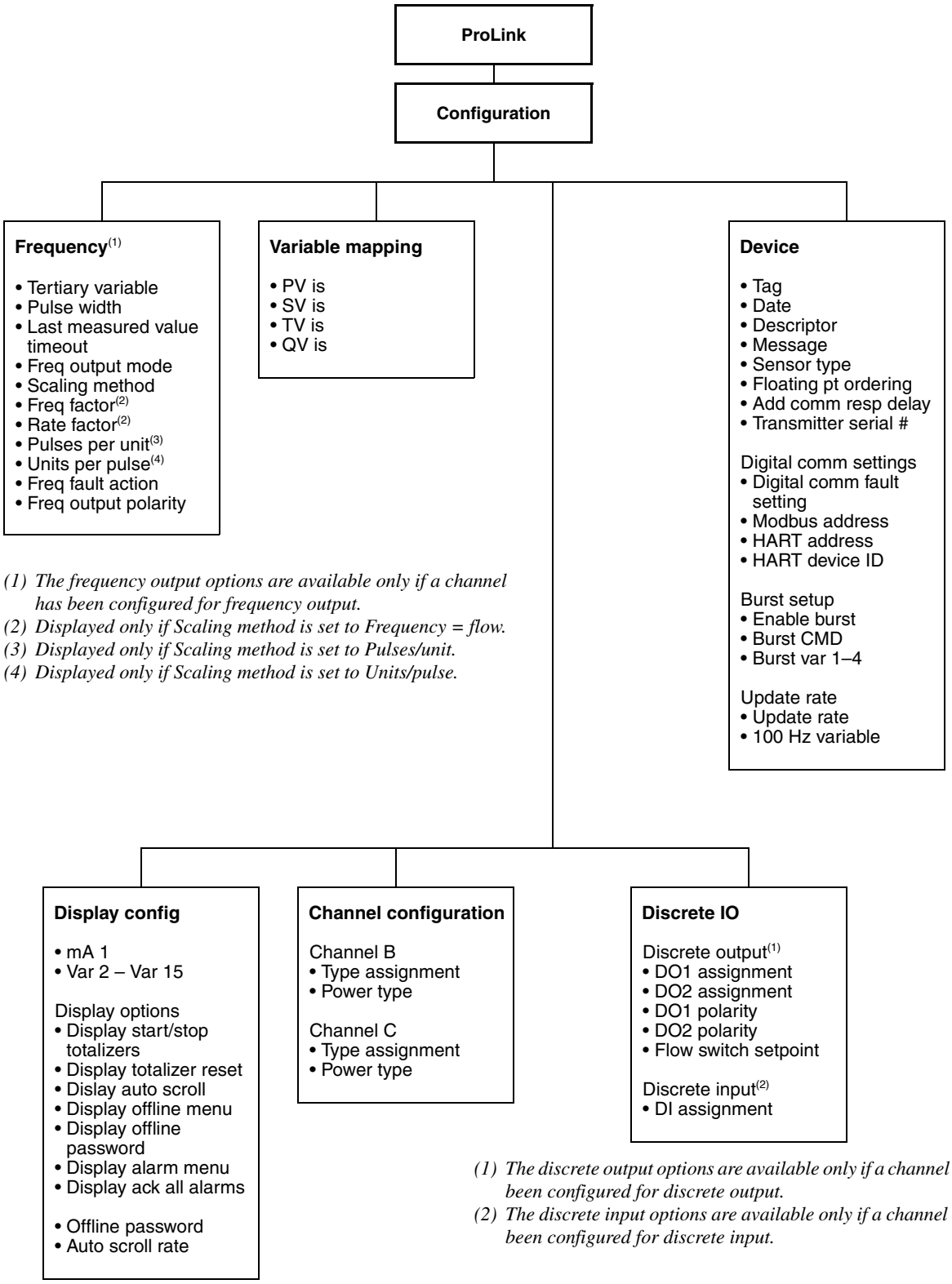
Figure I-1 ProLink II configuration menu



(1) The API Setup parameters appear only if the petroleum measurement application is enabled on your transmitter.

(2) The secondary mA output options are available only if Channel B has been configured for mA output.

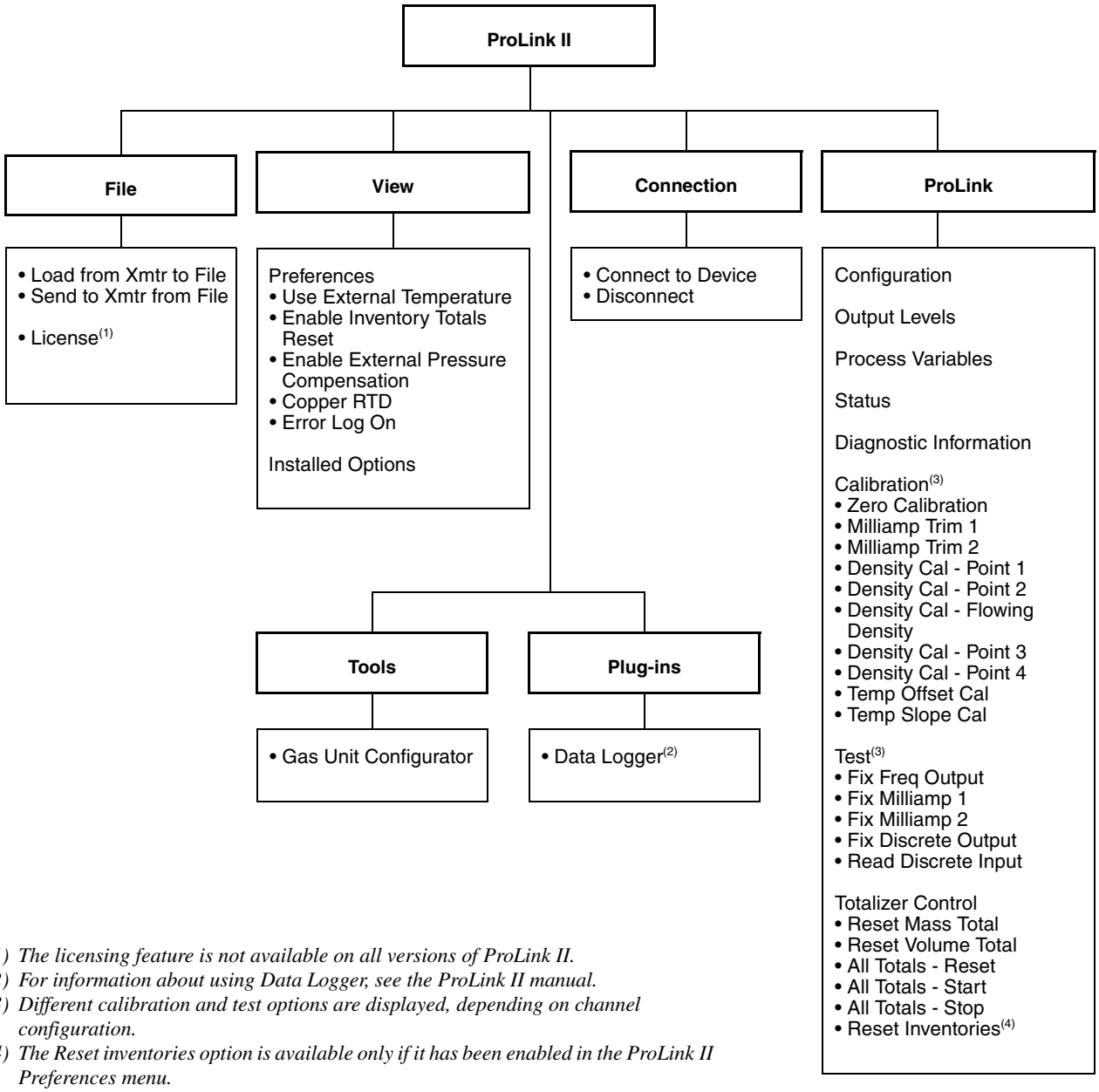
Figure I-2 ProLink II configuration menu (continued)



(1) The frequency output options are available only if a channel has been configured for frequency output.
(2) Displayed only if Scaling method is set to Frequency = flow.
(3) Displayed only if Scaling method is set to Pulses/unit.
(4) Displayed only if Scaling method is set to Units/pulse.

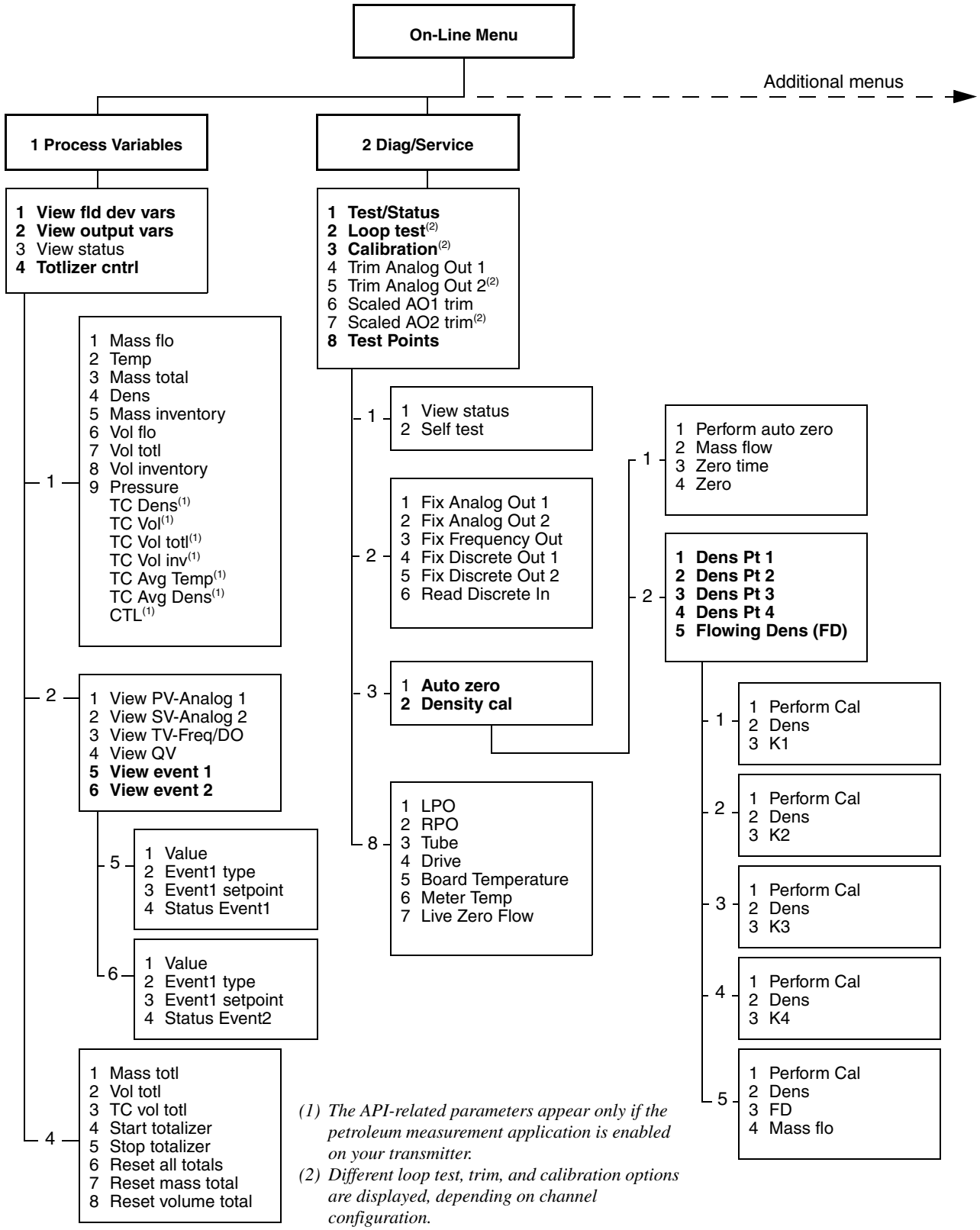
(1) The discrete output options are available only if a channel has been configured for discrete output.
(2) The discrete input options are available only if a channel has been configured for discrete input.

Figure I-3 ProLink II operating menus



(1) The licensing feature is not available on all versions of ProLink II.
(2) For information about using Data Logger, see the ProLink II manual.
(3) Different calibration and test options are displayed, depending on channel configuration.
(4) The Reset inventories option is available only if it has been enabled in the ProLink II Preferences menu.

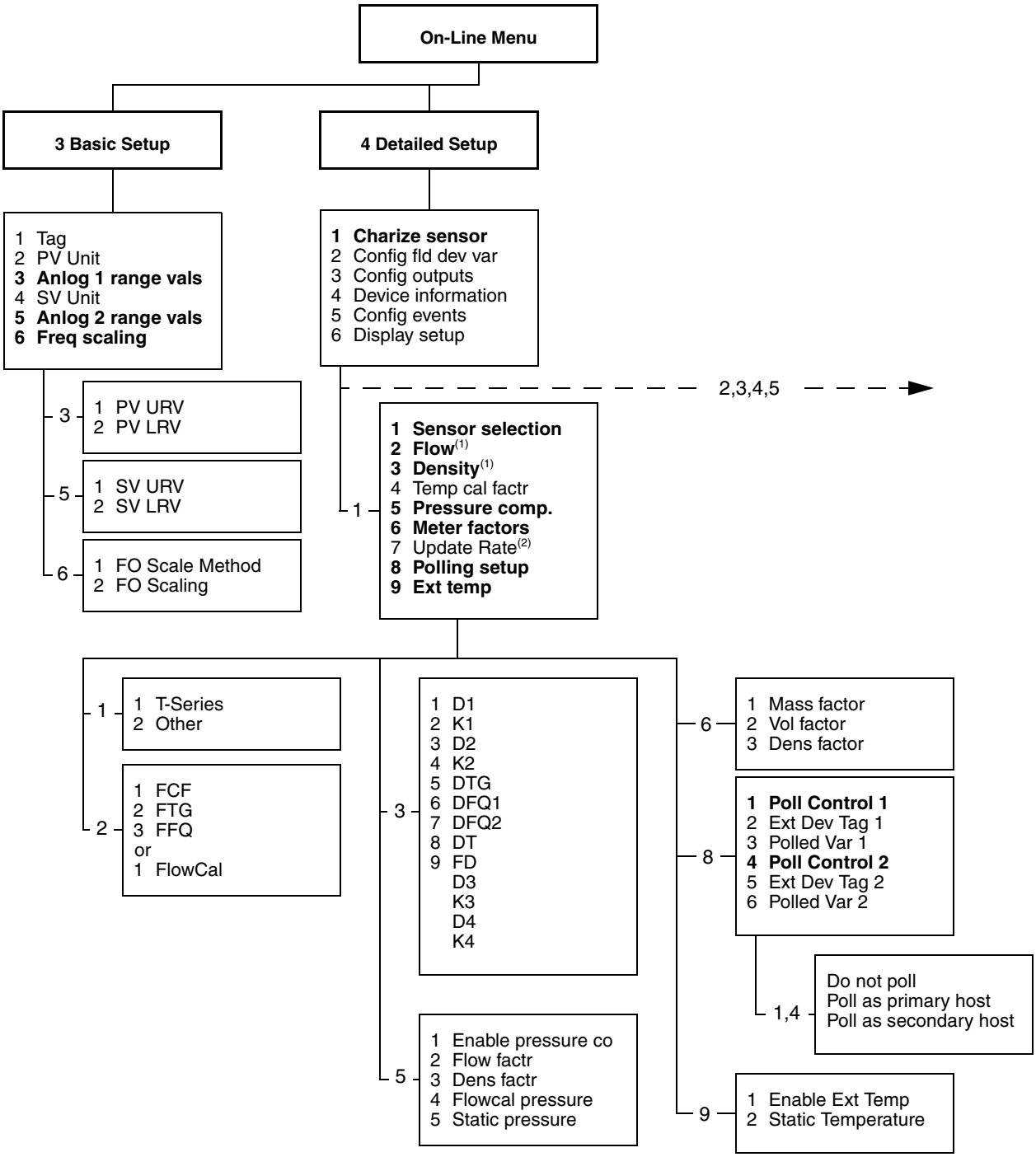
Figure I-4 Communicator menus



(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

(2) Different loop test, trim, and calibration options are displayed, depending on channel configuration.

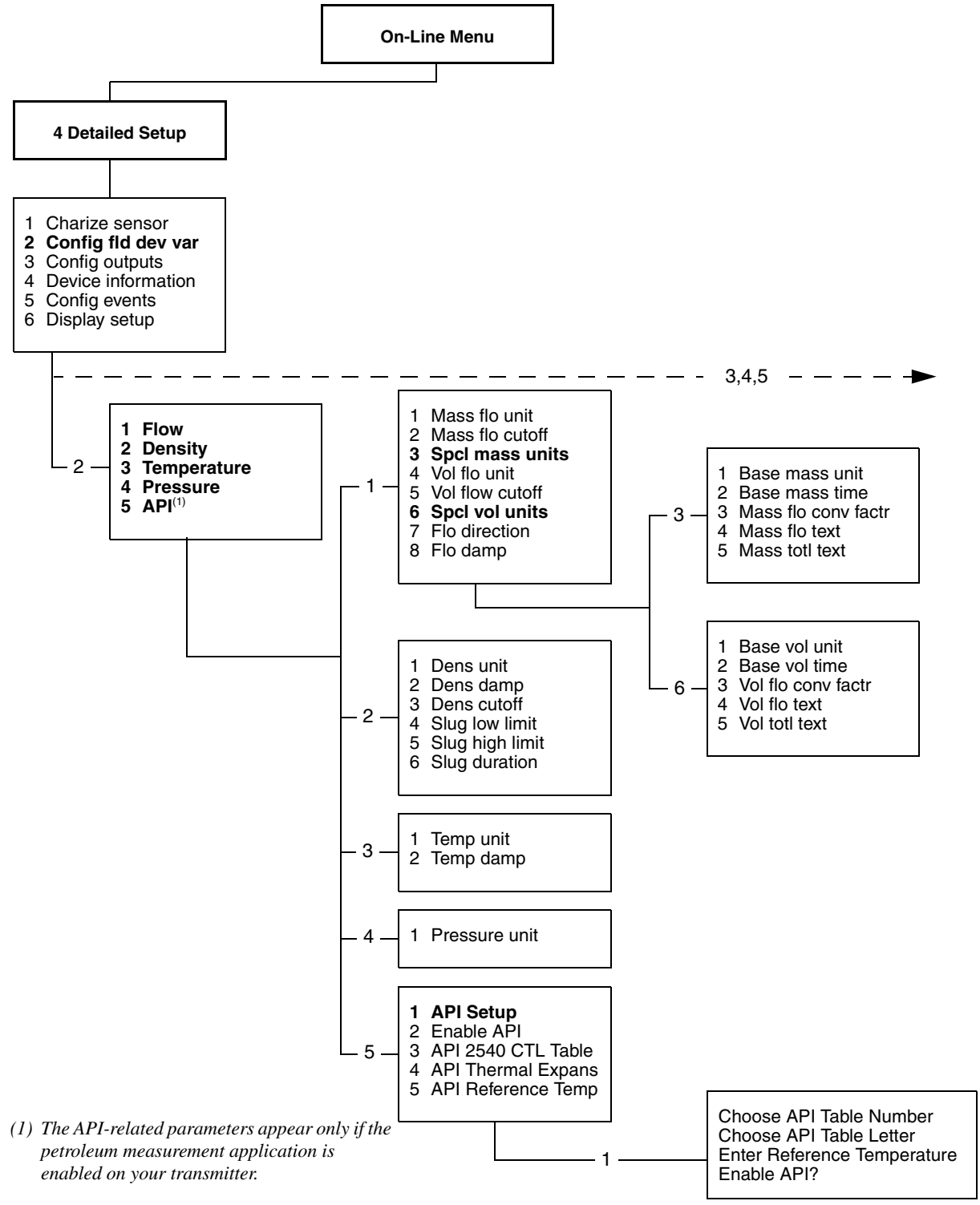
Figure I-5 Communicator menus (confined)



(1) Different flow and density parameters are displayed depending on your sensor selection. Menu numbers are adjusted accordingly. For more information, see Section 6.2.

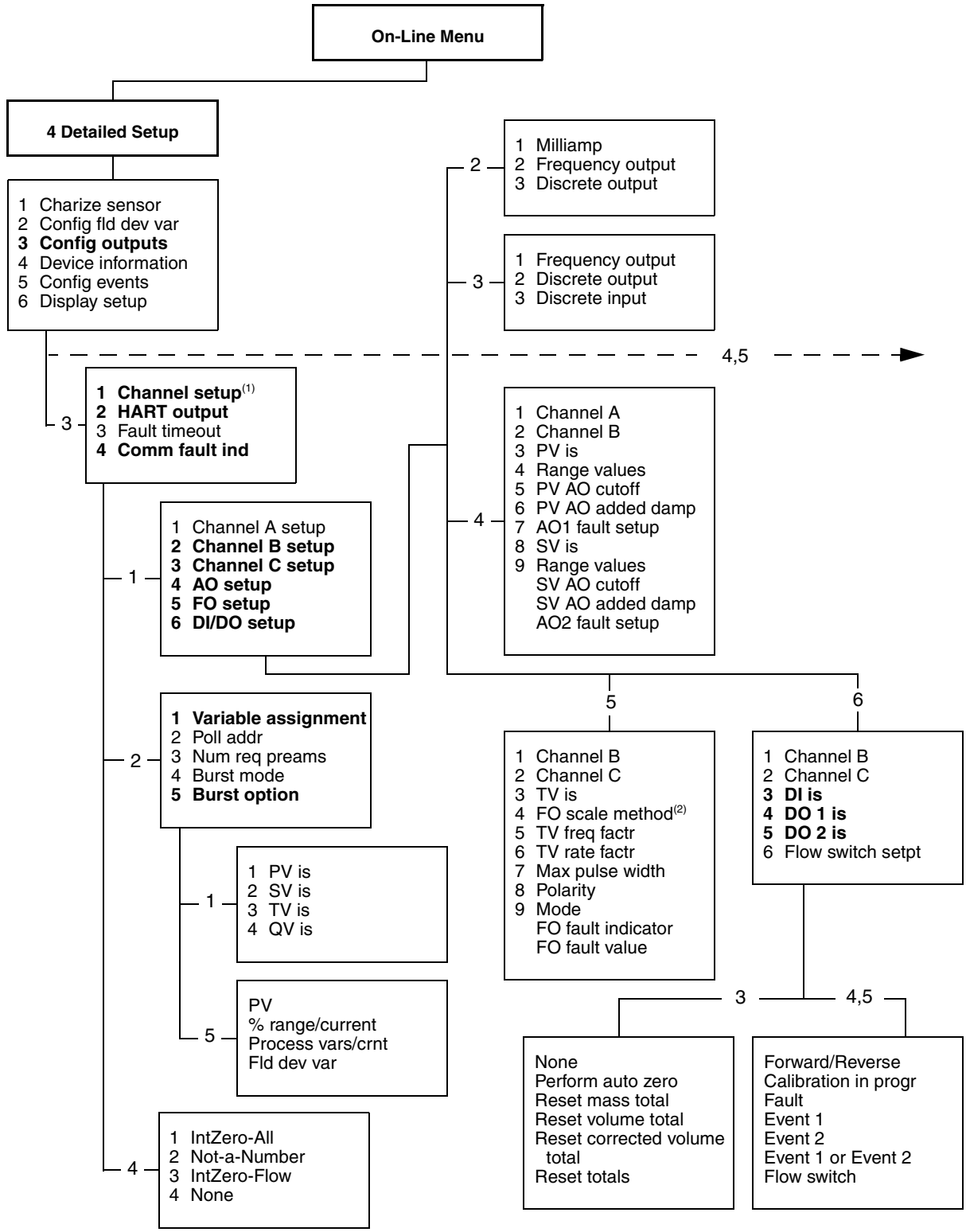
(2) If Update Rate is set to Special, a parameter called Update Rate Var is listed directly beneath Update Rate. Menu numbers are adjusted accordingly.

Figure I-6 Communicator menus (continued)



(1) The API-related parameters appear only if the petroleum measurement application is enabled on your transmitter.

Figure I-7 Communicator menus (confined)



(1) As channel configuration options are selected, different options are displayed at lower levels of the menu. Menu numbers are adjusted accordingly. This menu does not show all configuration options.

(2) Different frequency output parameters are displayed depending on the scaling method selected.

Figure I-8 Communicator menus (confined)

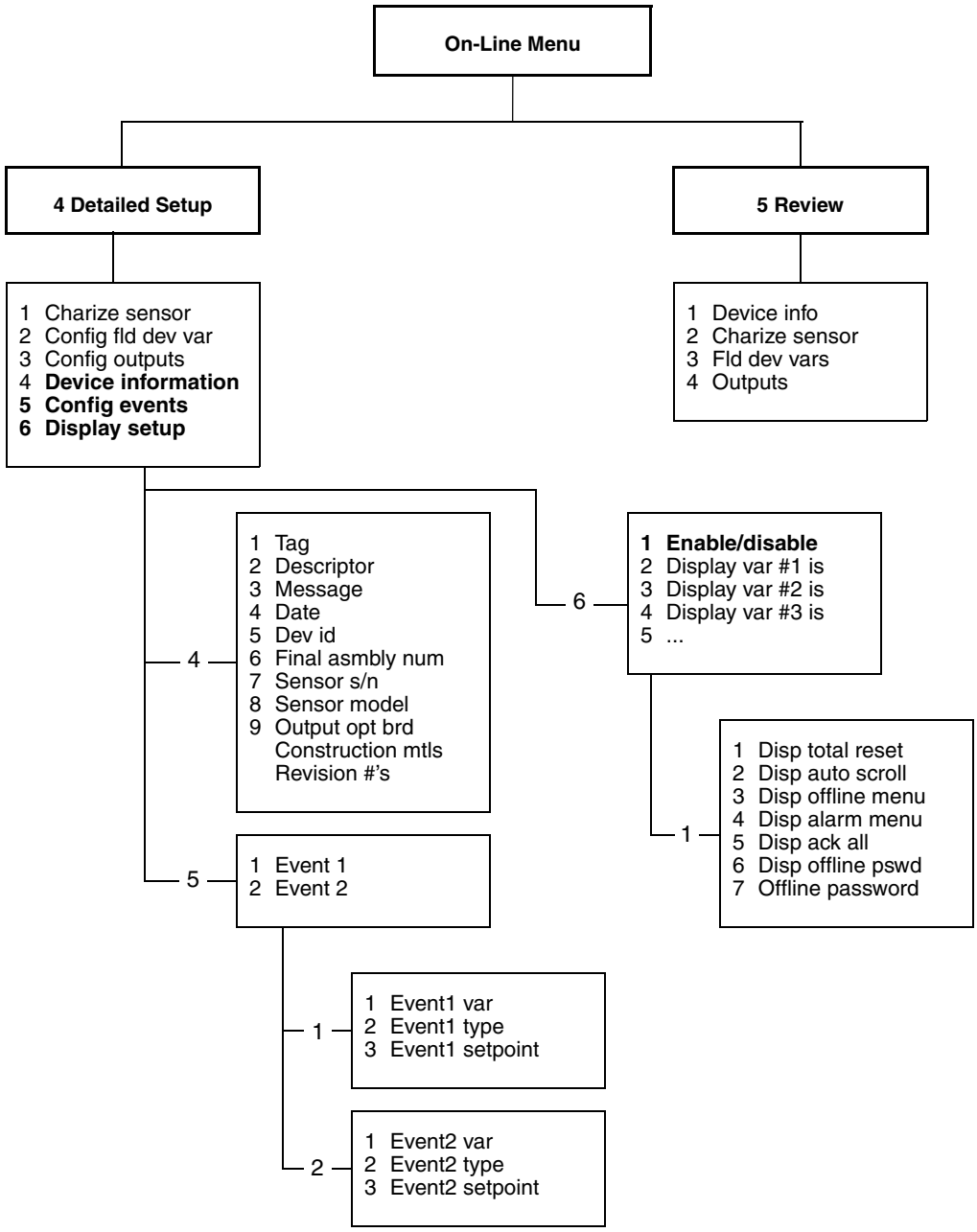
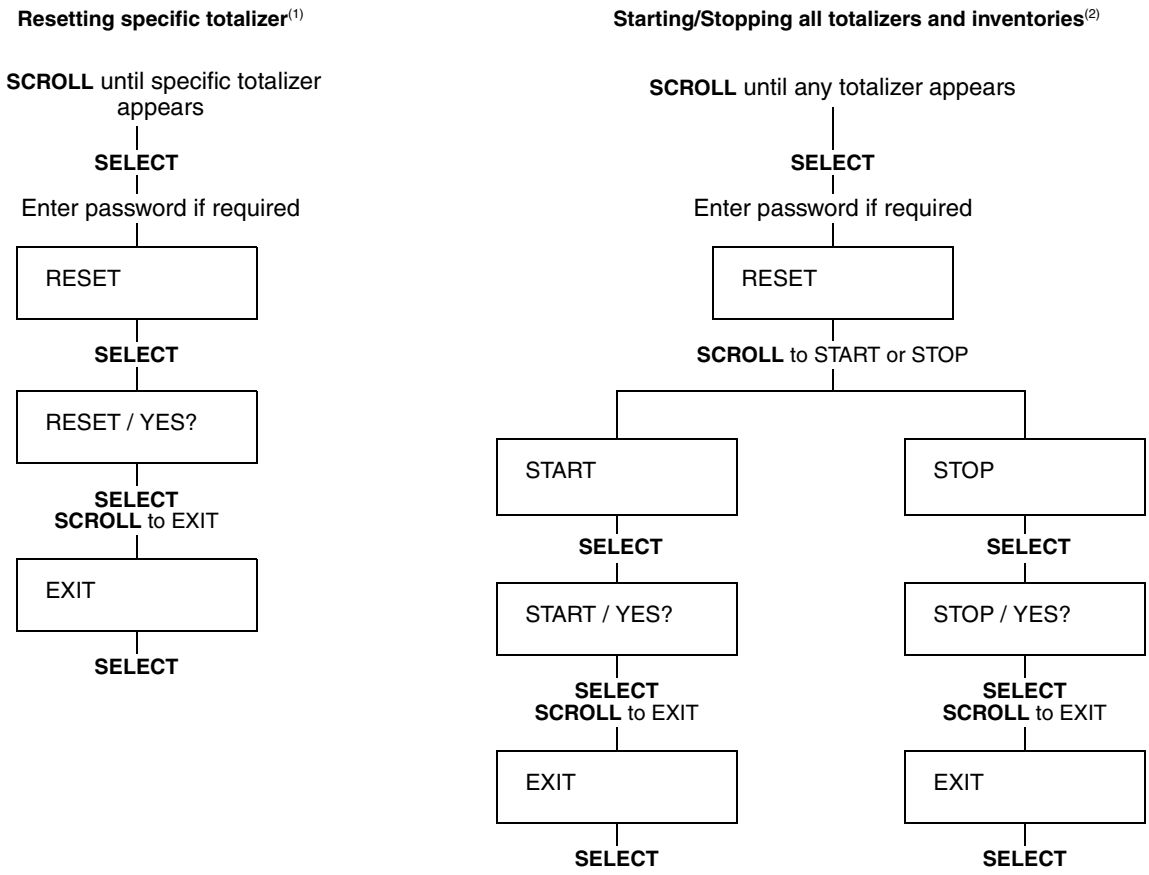


Figure I-9 Display menu – Managing totalizers and inventories



(1) Transmitter must be configured to allow resetting totalizers from display. See Section 8.14.1.
(2) Transmitter must be configured to allow starting and stopping totalizers from display. See Section 8.14.1.

Figure I-10 Display menu – Maintenance – Version information

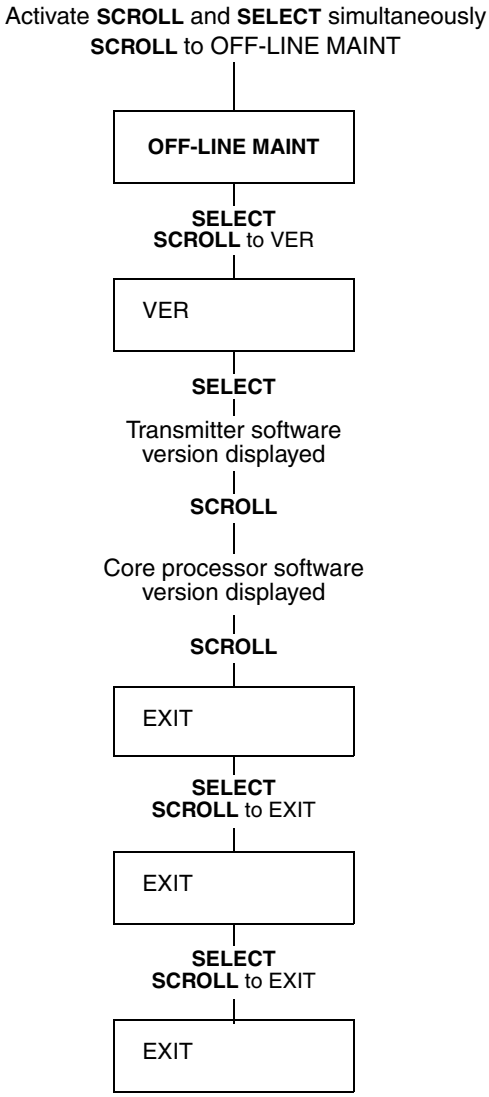
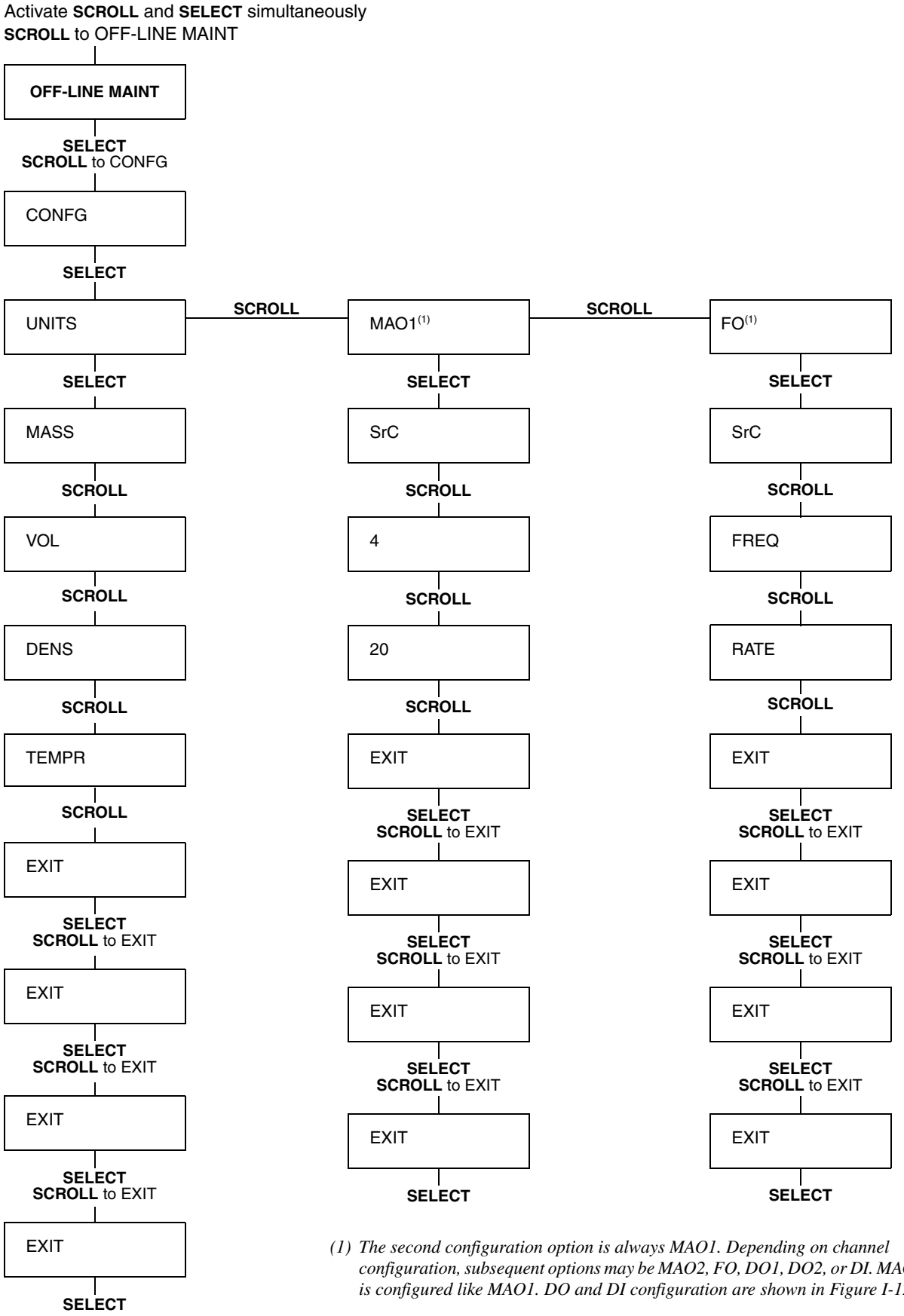
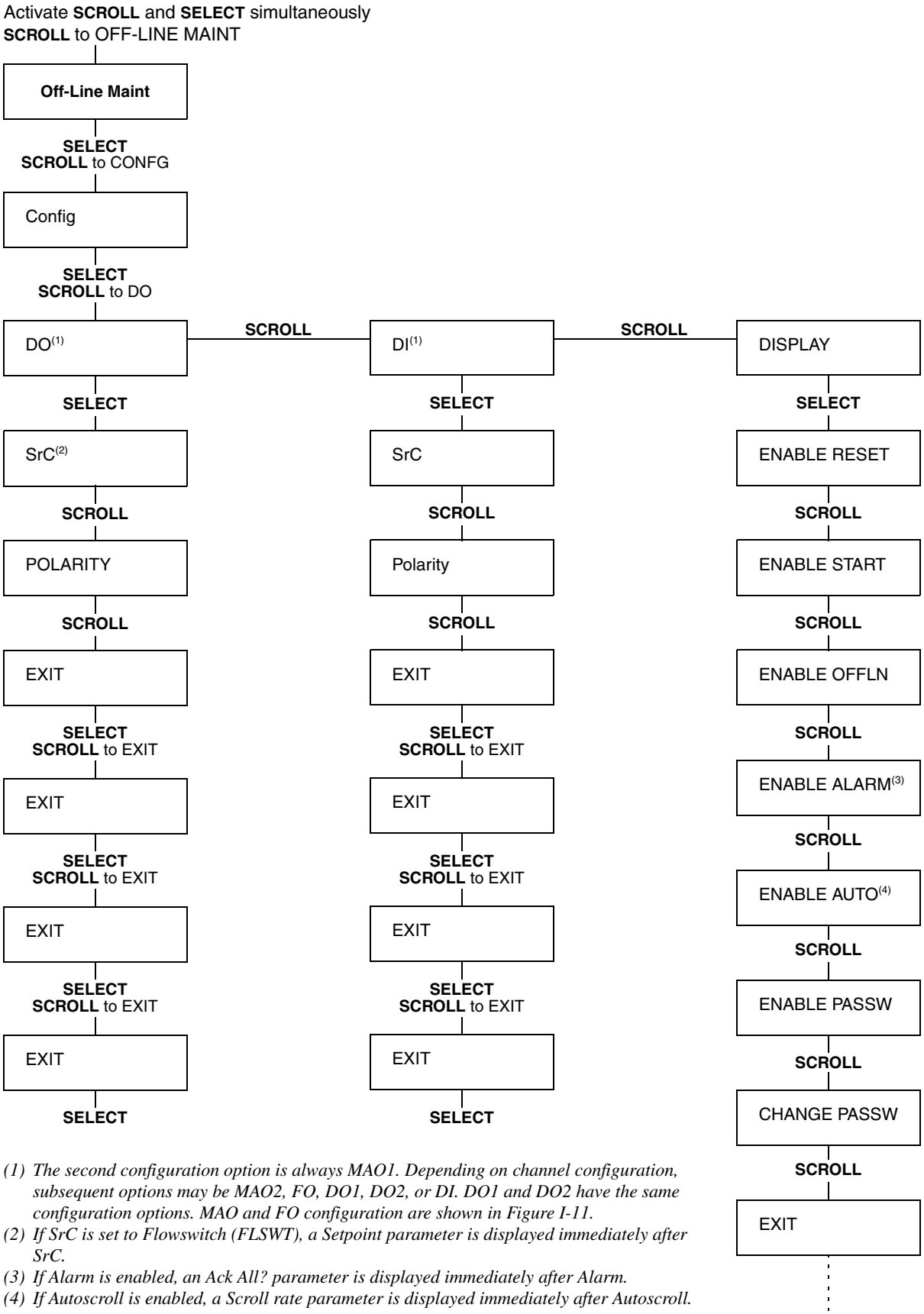


Figure I-11 Display menu – Maintenance – Configuration: Units, mA output(s), frequency output(s)



(1) The second configuration option is always MAO1. Depending on channel configuration, subsequent options may be MAO2, FO, DO1, DO2, or DI. MAO2 is configured like MAO1. DO and DI configuration are shown in Figure I-12.

Figure I-12 Display menu – Maintenance – Configuration: Discrete output(s), discrete input, display



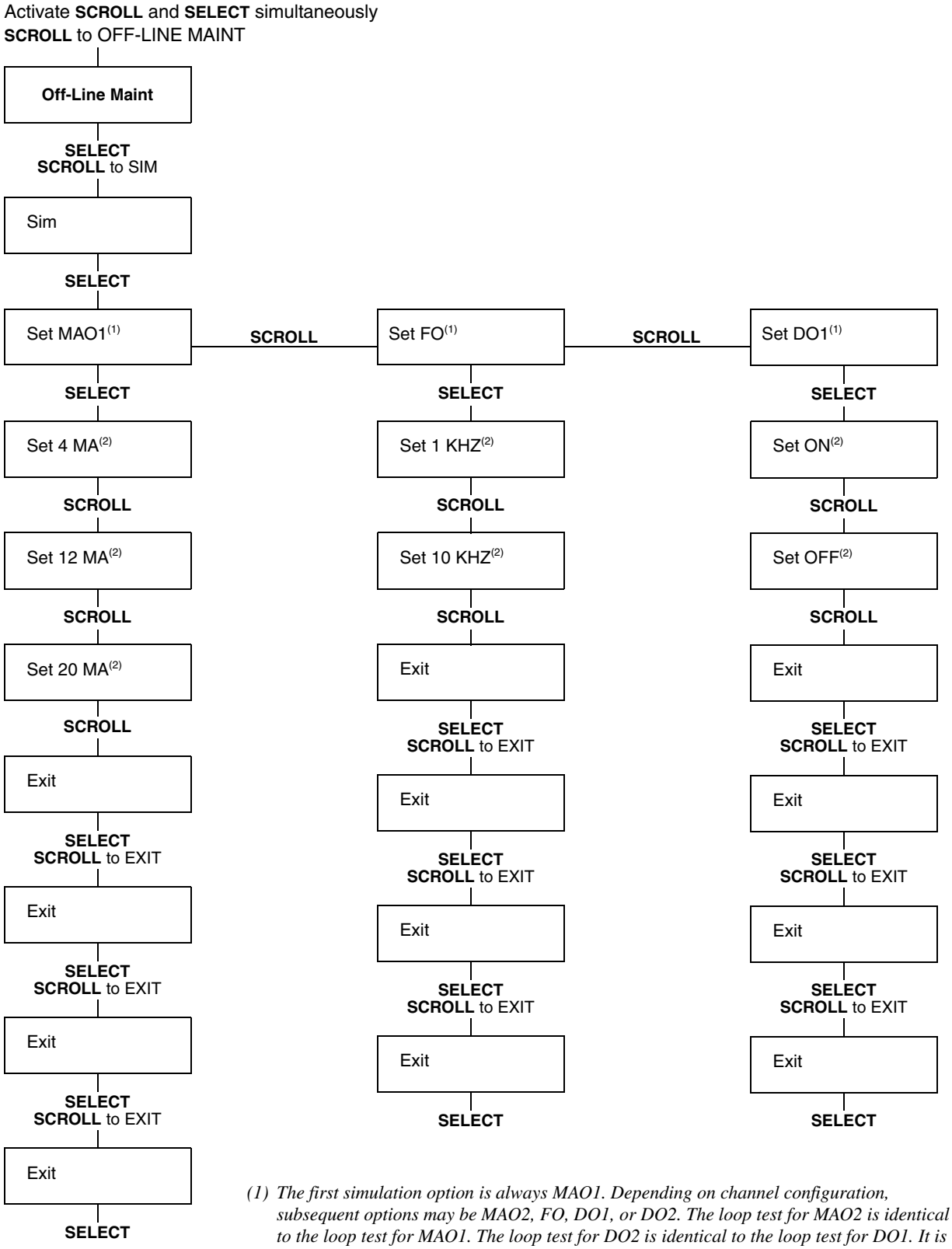
(1) The second configuration option is always MAO1. Depending on channel configuration, subsequent options may be MAO2, FO, DO1, DO2, or DI. DO1 and DO2 have the same configuration options. MAO and FO configuration are shown in Figure I-11.

(2) If SrC is set to Flowswitch (FLSWT), a Setpoint parameter is displayed immediately after SrC.

(3) If Alarm is enabled, an Ack All? parameter is displayed immediately after Alarm.

(4) If Autoscroll is enabled, a Scroll rate parameter is displayed immediately after Autoscroll.

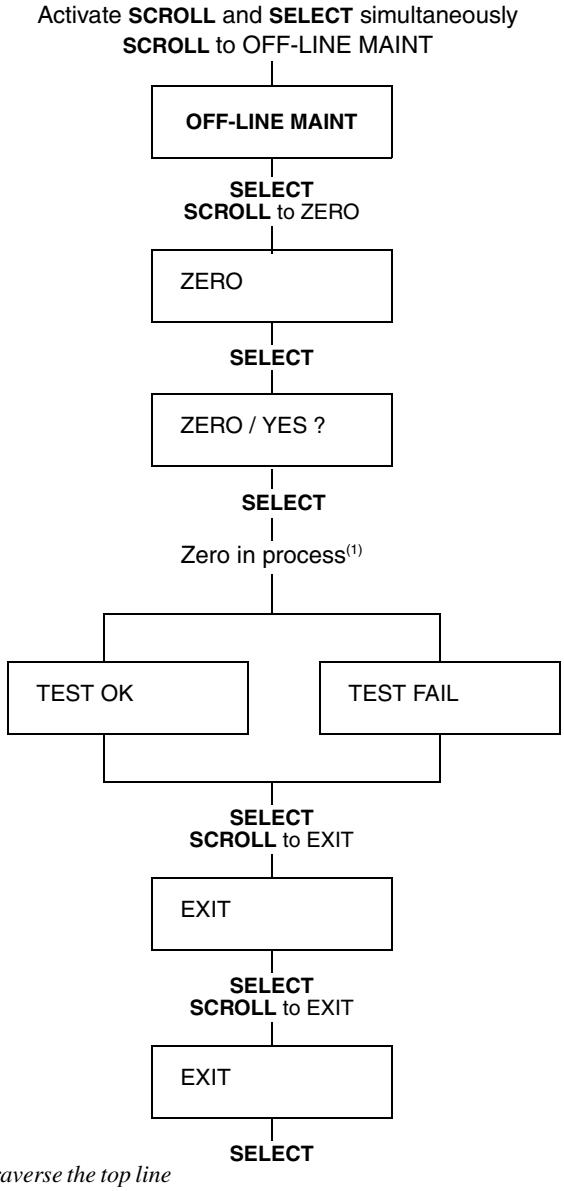
Figure I-13 Display menu – Simulation (loop testing)



(1) The first simulation option is always MAO1. Depending on channel configuration, subsequent options may be MAO2, FO, DO1, or DO2. The loop test for MAO2 is identical to the loop test for MAO1. The loop test for DO2 is identical to the loop test for DO1. It is not possible to test the discrete input (DI) with the display.

(2) Activate SELECT to begin simulation. Dots traverse the top line of the display while simulation is in process. To end simulation, activate SELECT again.

Figure I-14 Display menu – Zero



(1) While zero is in process, dots traverse the top line of the display and the status LED flashes yellow.

Appendix J
Display Codes and Abbreviations

J.1 Overview

This appendix provides information on the codes and abbreviations used on the transmitter display.

Note: Information in this appendix applies only to transmitters that have a display.

J.2 Codes and abbreviations

Table J-1 lists and defines the codes and abbreviations that are used for display variables (see Section 8.14.4 for information on configuring display variables).

Table J-2 lists and defines the codes and abbreviations that are used in the off-line menu.

These tables do not list terms that are spelled out completely. These tables do not list most measurement units, but do list measurement units related to the petroleum measurement application or the enhanced density application.

Table J-1 Display codes used for display variables

Code or abbreviation	Definition	Comment or reference
AVE_D	Average density	
AVE_T	Average temperature	
BRD_T	Board temperature	
CONC	Concentration	
DRIVE%	Drive gain	
EXT_T	External temperature	
LPO_A	Left pickoff amplitude	
LVOLI	Volume inventory	
LZERO	Live zero flow	
MASSI	Mass inventory	
MTR_T	Case temperature (T-Series sensors only)	
NET M	Mass flow rate	
NET V	Volume flow rate	
NETMI	Net mass inventory	
NETVI	Net volume inventory	
PWRIN	Input voltage	Refers to power input to the core processor
RDENS	Density at reference temperature	
RPO_A	Right pickoff amplitude	
SGU	Specific gravity units	

Table J-1 Display codes used for display variables

Code or abbreviation	Definition	Comment or reference
STD V	Standard volume flow rate	
STD V	Standard volume flow rate	
STDVI	Standard volume inventory	
TCDENS	Temperature-corrected density	
TCORI	Temperature-corrected inventory	
TCORR	Temperature-corrected total	
TCVOL	Temperature-corrected volume	
TUBEF	Raw tube frequency	
WTAVE	Weighted average	

Table J-2 Display codes used in off-line menu

Code or abbreviation	Definition	Comment or reference
ACK ALARM	Acknowledge alarm	
ACK ALL	Acknowledge all	
CHANGE PASSW	Change password	Change the password required for access to display functions
CONFG	Configuration	
CORE	Core processor	
DENS	Density	
DGAIN	Drive gain	
DI	Discrete input	
DISBL	Disable	**Select** to disable
DO1	Discrete output 1	
DO2	Discrete output 2	
DSPLY	Display	
E1OR2	Event 1 or event 2	
ENABL	Enable	**Select** to enable
ENABLE ACK	Enable acknowledge	Enable or disable the ACK ALL function
ENABLE ALARM	Enable alarm menu	Access to alarm menu from display
ENABLE AUTO	Enable autoscroll	
ENABLE OFFLN	Enable off-line	Access to off-line menu from display
ENABLE PASSW	Enable password	Enable or disable password protection for display functions
ENABLE RESET	Enable totalizer reset	Enable or disable totalizer reset from display
ENABLE START	Enable totalizer start	Enable or disable totalizer start/stop from display
EVNT1	Event 1	
EVNT2	Event 2	
FLDIR	Flow direction	

Table J-2 Display codes used in off-line menu

Code or abbreviation	Definition	Comment or reference
FLSWT	Flow switch	
FO	Frequency output	
FREQ	Frequency	
M_ASC	Modbus ASCII	
M_RTU	Modbus RTU	
MAO1	mA output 1 (primary mA output)	
MAO2	mA output 2 (secondary mA output)	
MASS	Mass flow	
MBUS	Modbus	
MFLOW	Mass flow	
OFF-LINE MAINT	Off-line maintenance	
r.	Revision	
SIM	Simulation	
SPECL	Special	
SrC	Source	
TEMPR	Temperature	
VER	Version	
VFLOW	Volume flow	
VOL	Vol flow	
XMTR	Transmitter	

Index

Numerics

275 HART Communicator
  See also HART Communicator, Communicator
  support for Series 1000/2000 transmitters 23
375 Field Communicator
  See also Communicator
  support for Series 1000/2000 transmitters 23

A

Acknowledging alarms 74
Added damping 57
Alarm queue 72
Alarms
  acknowledging 74
  status 117
  viewing 71
AMS
  requirements 127
Analog output cutoff
  See AO cutoff
AO cutoff 55
API
  See Petroleum measurement application
API inventory
  viewing 76
API parameters 83
API process variables
  viewing 71
API totalizer
  viewing 76
Assignment
  discrete input configuration 67
  discrete output configuration 66
Autozero 38

B

Base mass unit 81
Base time unit 81
Base volume unit 81
Baud rate 97
Black Box 11
Burst mode
  configuration 99
Button
  See Optical switch

C

Calibrating 157
  density calibration 157
  failure 113
  temperature calibration 164
  troubleshooting 129
  when to calibrate 157
Calibration parameters 44
Channels
  configuration 47
Characterizing
  characterization parameters 44
  density calibration factors 45
  flow calibration parameters 46
  how to characterize 46
  troubleshooting 129
  when to characterize 44
Codes
  used in manual 3
Coil
  testing resistance 136
Communication device, troubleshooting 126
Communication loop, troubleshooting 126
Communication tools 4
Communicator
  connecting to transmitter 25
  conventions 27
  loop testing 34
  requirements 126
  resetting
    inventories 78
    totalizers 78
  safety messages 27
  starting and stopping
    inventories 78
    totalizers 78
  trimming mA output 37
  viewing
    API process variables 71
    mass inventory 75
    mass totalizer 75
    process variables 70
    status and alarms 73
    volume inventory 75
    volume totalizer 75
  zeroing 41

Configuration
baud rate 97
burst mode 99
channels 47
cutoffs 86
damping 86
density measurement unit 52
device settings 101
digital communications parameters 96
digital fault indicator 96
discrete input 67
discrete output 64
assignment 66
polarity 66
display off-line password 95
display parameters 94
display scroll rate 95
display variables 95
enhanced density application 165
events 92
fault timeout 93
flow direction parameter 88
frequency output 58
fault indicator 64
maximum pulse width 61
mode 63
polarity 62
process variable 59
scale 60
HART polling address 97
mA output 53
added damping 57
AO cutoff 55
fault indicator 56
process variable 54
range 55
mass flow measurement unit 50
measurement units 49
special 81
meter factors 93
Modbus address 97
optional 79
parameter access 79
parity 97
petroleum measurement application 83
polling 107
pre-configuration worksheet 5
pressure compensation 105
protocol 97
PV, SV, TV, and QV 100
required 43
RS-485 parameters 97
saving to a file 11
sensor parameters 102
slug flow parameters 92
special measurement units 81
stop bits 97
temperature measurement unit 52
terminals 47
update rate 87
volume flow measurement unit 51
Configuration files
upload and download 11
Configuration map 79
Configuration tools 4
Connecting the Communicator 25
Conversion factor 81
Core processor
components 147, 153
resistance test 134
troubleshooting 132
Core processor LED
troubleshooting 132
Curve trim 171
Custody transfer application 69
Customer service, contacting 112
Cutoffs
configuration 86

D

Damping
configuration 86
See also Added damping
Default values 141, 241
Density
calibration 157
calibration factors 45
cutoff 86
factor 104
measurement unit
configuration 52
list 52
Density curve trim 171
Derived variable 167
Device descriptions
275 HART Communicator 23
375 Field Communicator 23
Device settings
configuration 101
Digital communications parameters
configuration 96

Discrete input
assignment options 67
configuration 67
assignment 67
Discrete output
assignment options 66
configuration 64
assignment 66
polarity 66
troubleshooting 126
voltage levels 64
Display
alarms and acknowledging 74
components 7
entering mA and frequency output range values 9
loop testing 31
off-line password 95
optical switch 8
password 9
resetting
inventories 76
totalizers 76
scroll rate 95
starting and stopping
inventories 76
totalizers 76
using 8
using the menus 8
variables 95
viewing
API process variables 71
mass inventory 74
mass totalizer 74
process variables 70
status and alarms 72
volume inventory 74
volume totalizer 74
zeroing 39
Display parameters
configuration 94
enabling and disabling 94
Display variables 95
Documentation 3
manual conventions 3
terminology 3
Drive gain
erratic 131
excessive 131
Dual pulse
See Mode

E

Enhanced density application 69, 165
configuration 165
density curve trim 171
derived variable 167
preconfigured curves 169
Erratic drive gain 131
Events
configuration 92
reporting status 92
Excessive drive gain 131
EXPERT$_2$ 112
External temperature compensation 106

F

Fault conditions 113
Fault indicator
digital 96
frequency output configuration 64
mA output configuration 56
Fault timeout
configuration 93
Field Communicator
See 375 Field Communicator, Communicator
Flow calibration parameters 46
Flow calibration pressure 104
Flow direction parameter
configuration 88
Flow factor 104
Flow switch
definition 67
Flowmeter
calibrating 157
Frequency output
configuration 58
fault indicator 64
maximum pulse width 61
mode 63
polarity 62
scale 60
entering range values with the display 9
troubleshooting 126
voltage levels 58
Frequency output scale
definition 60
troubleshooting 129

G

Grounding
troubleshooting 126

H

HART burst mode
- *See* Burst mode 99

HART Communicator 173
- compatibility with transmitter 173
- Model 275 173, 183
- Model 375 173, 183
- *See also* 275 HART Communicator, Communicator

HART Communicator 275
- connecting with Model 2500 transmitter 24

HART interface 11

HART polling address 97, 129

HART/Bell202 connections
- Model 1500/2500 transmitters
  - connecting with ProLink II 21
- Model 1700/2700 transmitters
  - connecting with ProLink II 16

I

Installation
- output terminals
  - Model 1500 transmitters 148
  - Model 1700/2700 transmitters 155
  - Model 2500 transmitters 149
- power supply terminals
  - Model 1500/2500 transmitters 147
  - Model 1700/2700 transmitters 155
- sensor wiring
  - Model 1500/2500 transmitters 147
  - Model 1700/2700 transmitters 154
- terminal configuration options
  - Model 1500 transmitters 148
  - Model 2500 transmitters 149
- types 1
  - Model 1500/2500 transmitters 146
  - Model 1700/2700 transmitters 151

Inventories
- definition 74
- resetting 76
- starting and stopping 76
- viewing 74

L

LED
- *See* Status LED, core processor LED

Loop test 31
- with Communicator 34
- with display 31
- with ProLink II 33

Low pickoff voltage 132

LRV
- *See also* Range
- troubleshooting 129

M

mA output
- configuration 53
  - added damping 57
  - AO cutoff 55
  - fault indicator 56
  - process variable 54
  - range 55
- entering range values with the display 9
- trimming 35

Mass flow
- cutoff 86
- measurement unit
  - configuration 50
  - list 50

Maximum pulse width 61
- definition 61

Measurement units
- configuration 49
- pressure 104
- special 81
  - gas unit 82
  - mass flow unit 82
  - volume flow unit 82
- troubleshooting 129

Meter factors
- calculation 93
- configuration 93

Modbus address 97

Mode 63

Model 1500/2500 transmitter
- connecting with ProLink II 19

Model 1700/2500 transmitter
- connecting with Communicator 25

Model 1700/2700 transmitter
- connecting with ProLink II 12

Model 2500 transmitter
- connecting with HART Communicator 275 24

Model number 1

O

Off-line password 95

Optical switch 8

Output saturation 128

Output scale, troubleshooting 129

Output wiring, troubleshooting 127

Output, troubleshooting
    frequency output 113
    HART 113
    mA output 113
Outputs option board 1

P
Parity 97
Password 9
    See also Off-line password
Petroleum measurement application 69
    configuration 83
Pickoff voltage 132
Polarity
    definition 62
    discrete output configuration 66
    frequency output configuration 62
Polling 107
    for pressure 107
    for temperature 107
Polling address
    See HART polling address 97
Power
    power-up 30
Power supply
    terminals
        Model 1500/2500 transmitters 147
        Model 1700/2700 transmitters 155
    troubleshooting 125
Pre-configuration worksheet 5
Pressure
    compensation 103
        configuration 105
        pressure correction factors 104
    correction factors 104
    effect 104
    measurement units
        configuration 104
        list 104
Primary variable 54, 100
Process variable
    frequency output configuration 59
    mA output configuration 54
    recording 69
    troubleshooting 122
    viewing 70
ProLink II
    configuration upload and download 11
    connecting to Model 1500/2500 transmitter 19
    connecting to Model 1700/2700 transmitter 12
    HART/Bell202 connections
        Model 1500/2500 transmitters 21
        Model 1700/2700 transmitters 16
    loop testing 33
    requirements 11, 127
    resetting
        inventories 77
        totalizers 77
    RS-485 connections
        Model 1500/2500 transmitters 19
        Model 1700/2700 transmitters 14
    saving configuration files 11
    service port connections
        Model 1500/2500 transmitters 20
        Model 1700/2700 transmitters 12
    starting and stopping
        inventories 77
        totalizers 77
    trimming mA output 35
    viewing
        API process variables 71
        mass inventory 75
        mass totalizer 75
        process variables 70
        status and alarms 73
        volume inventory 75
        volume totalizer 75
    zeroing 40
Protocol 97
Pulse width
    See Maximum pulse width
PV
    See Primary variable

Q
Quadrature
    See Mode
Quaternary variable 100
QV
    See Quaternary variable

R
Range 55
    troubleshooting 129
Receiving device, troubleshooting 127
Recording
    process variables 69
Remote core processor components 147, 153
Resistance
    testing coil 136
    testing core processor 134

RF (radio frequency) interference
troubleshooting 126
RS-485 connections
Model 1500/2500 transmitters
connecting with ProLink II 19
Model 1700/2700 transmitters
connecting with ProLink II 14
RS-485 parameters 97

S

Safety 1
Scale 60
Scroll rate 95
Secondary variable 54, 100
Sensor
testing coil resistance 136
Sensor parameters
configuration 102
Service port
Model 1500/2500 transmitters
connecting with ProLink II 20
Model 1700/2700 transmitters
connecting with ProLink II 12
Short to case test 136
Signal converter 11
Slug flow 128
Slug flow parameters
configuration 92
Slugs
definition 128
Special measurement units 81
base mass unit 81
base time unit 81
base volume unit 81
conversion factor 81
gas unit 82
mass flow unit 82
volume flow unit 82
Status
viewing 71
Status alarms 117
Status LED 72, 116
viewing status 72, 116
Stop bits 97
SV
See Secondary variable

T

Temperature
calibration 164
compensation 106
measurement unit
configuration 52
list 52
Terminals
configuration 47
Terminology 3
Tertiary variable 59, 100
Test points
troubleshooting 130
Testing
core processor resistance 134
sensor coil resistance 136
short to case 136
Totalizers
definition 74
resetting 76
starting and stopping 76
viewing 74
Transmitter
calibrating 157
configuration
optional 79
required 43
configuration map 79
default values 141, 241
installation type 1
model number 1
outputs option board 1
ranges 141, 241
special applications 69
type and version 1
versions 3
Transmitter components
4-wire remote installations 152
9-wire remote installations 153
integral installations 152
remote core processor with remote transmitter installations 152
transmitter/core processor assembly 153
Trimming the mA output 35
with Communicator 37
with ProLink II 35
Troubleshooting
alarms 117
calibration 113, 129
characterization 129
communication device 126
communication loop 126
core processor 132
core processor LED 132
core processor resistance test 134

customer service telephone number 112
discrete output 126
erratic drive gain 131
excessive drive gain 131
$EXPERT_2$ 112
fault conditions 113
frequency output 113, 126
frequency output scale and method 129
grounding 126
HART output 113
HART polling address 129
low pickoff voltage 132
mA output 113
mA output fixed 129
measurement range 129
measurement unit configuration 129
online system 112
output saturation 128
output wiring 127
power supply wiring 125
process variables 122
receiving device 127
RF (radio frequency) interference 126
sensor coil resistance 136
sensor-to-transmitter wiring 125
short to case 136
slug flow 128
status LED 116
test points 130
transmitter does not communicate 112
transmitter does not operate 112
wiring problems 125
zero failure 113
TV
See Tertiary variable

U

Update rate
configuration 87
URV
See also Range
troubleshooting 129

V

Variable assignment
primary variable 54, 100
quaternary variable 100
secondary variable 54, 100
tertiary variable 59, 100
Versions 3
Viator 11
Viewing
alarms 71
API inventory 76
API process variables 71
API totalizer 76
inventories 74
process variables 70
status 71
totalizers 74
Volume flow
cutoff 86
measurement unit
configuration 51
list 51

W

Wiring problems 125

Z

Zeroing 38
failure 113
with Communicator 41
with display 39
with ProLink II 40

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